SCIENTIFIC AMERICAN

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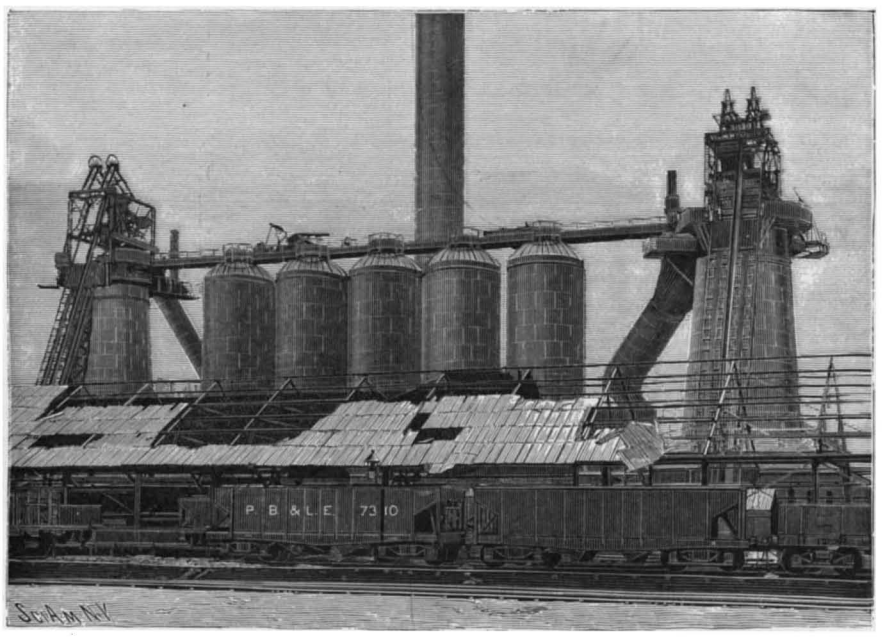
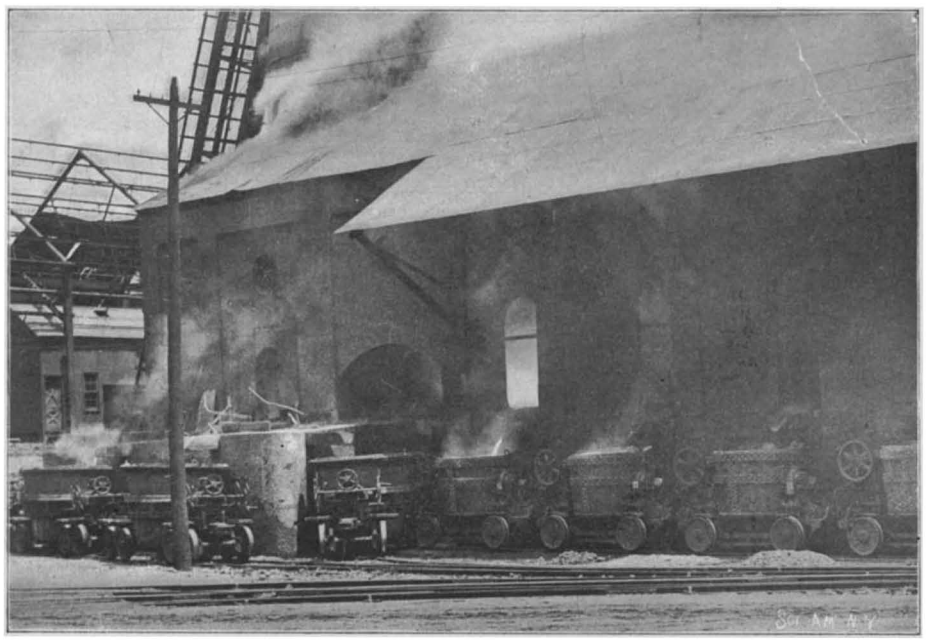
Vol. LXXXVI.—No. 17. ESTABLISHED 1845. NEW YORK, APRIL 26, 1902. [$3.00 A YEAR. 8 CENTS A COPY

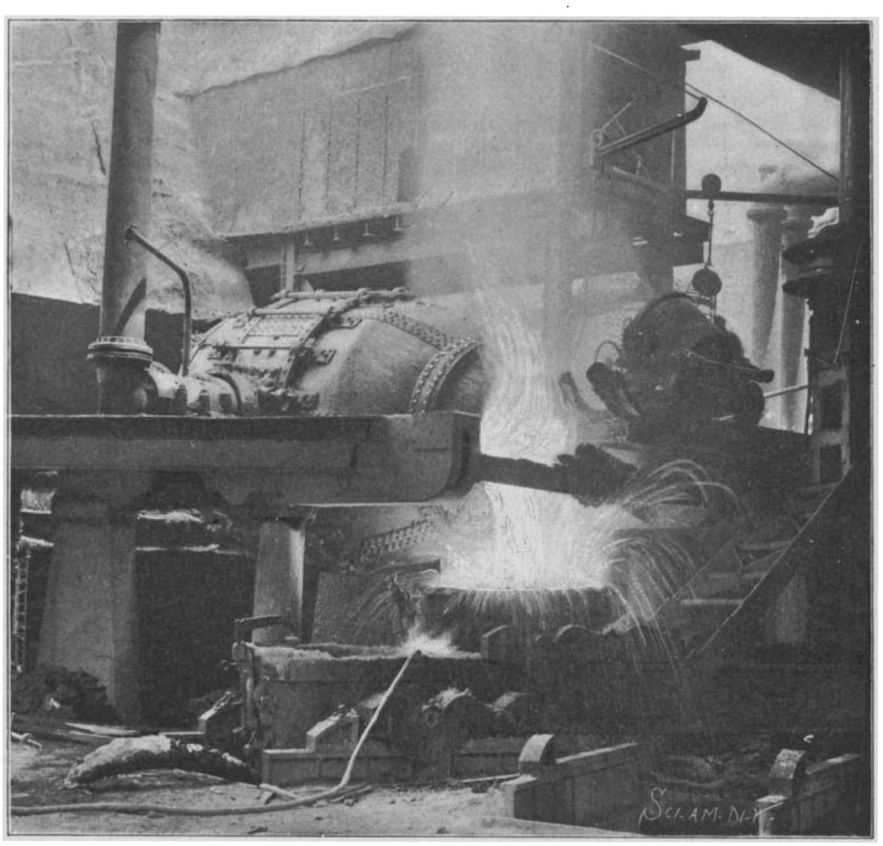


Blast Furnaces and Hot-Blast Stoves.

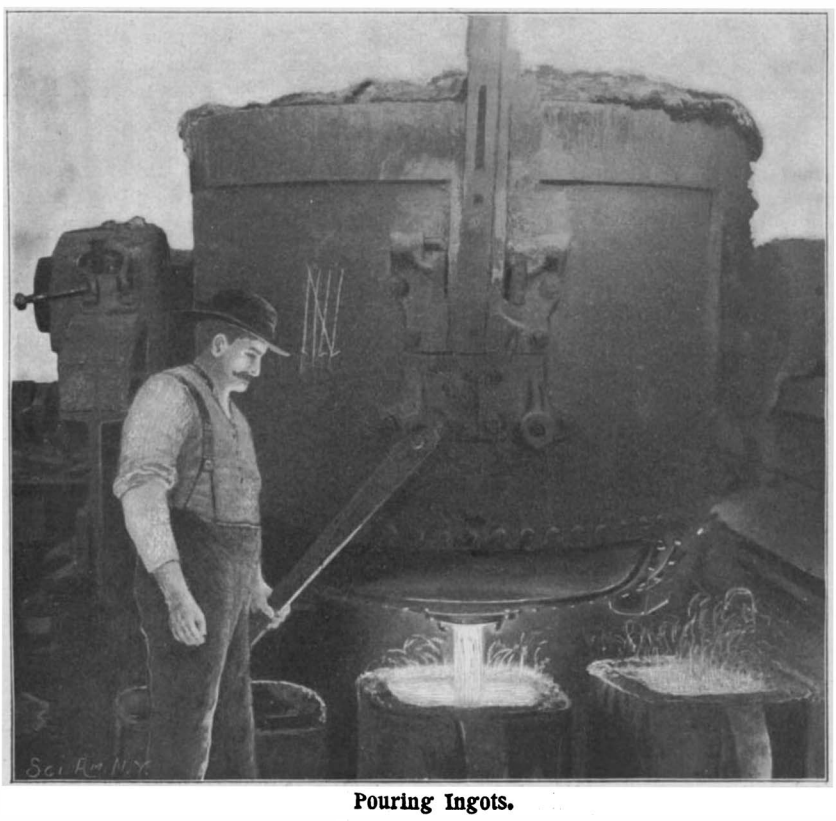


Tapping Contents of Blast Furnace Into Ladles.

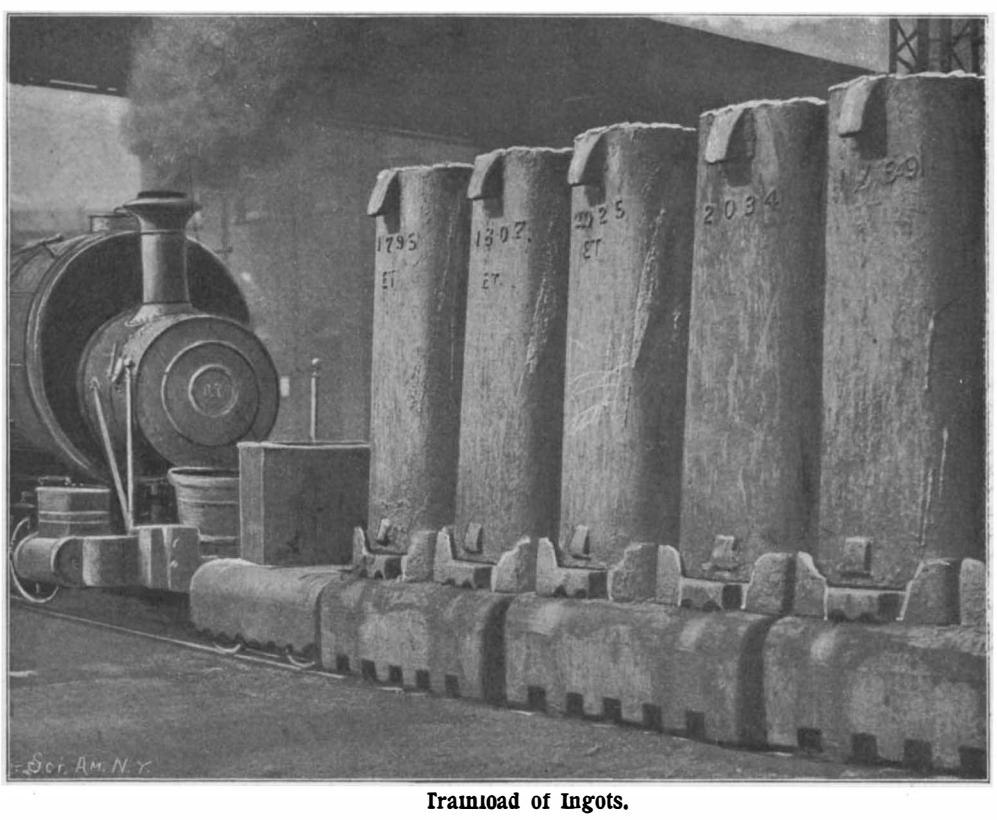
Pouring Hot Metal From Ladles Into Mixer.



Discharging Metal From Blower To Ladle.

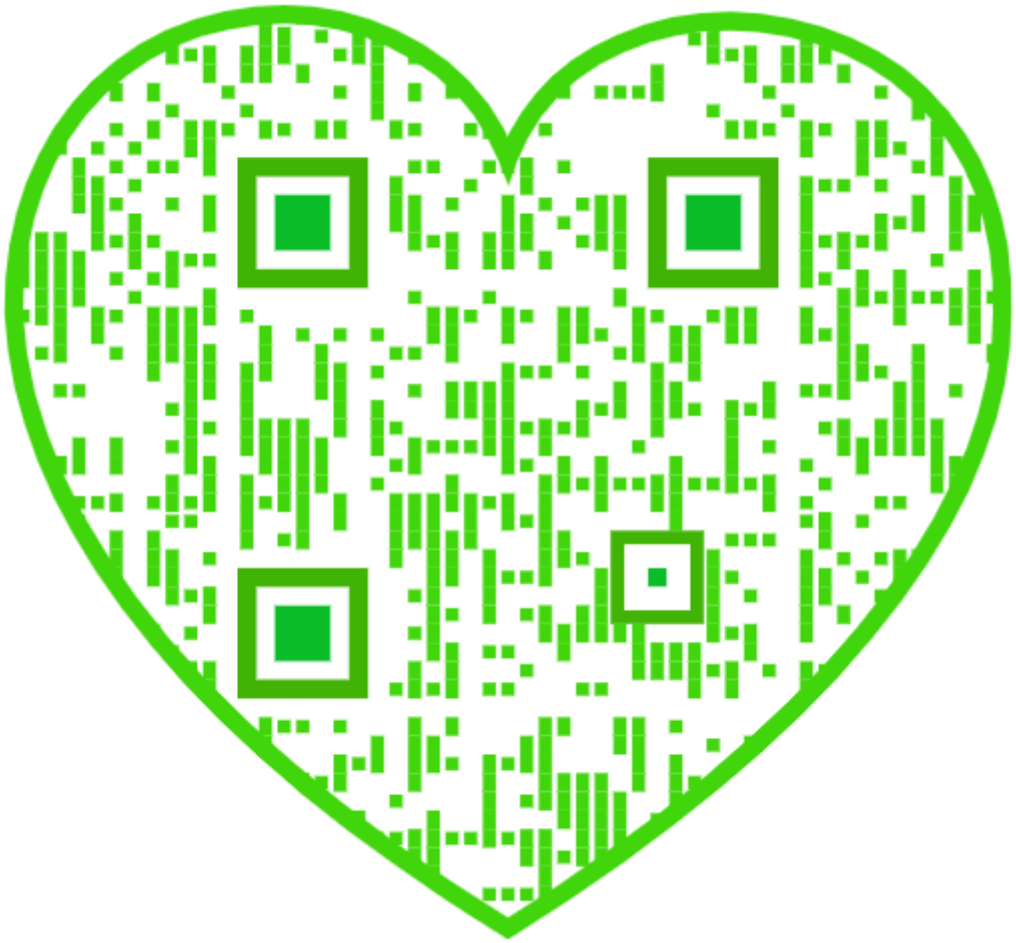


Pouring Ingots.



Trainload of Ingots.

MANUFACTURE OF STEEL RAILS.—[See page 292.]



SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

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Scientific American (Established 1845) .....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 26, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RECONSTRUCTION OF WEST POINT ACADEMY.

The decision of the Military Committee of the House to favor the appropriation for new buildings and plants at West Point is a welcome evidence of the fact that Congress is at last awakening to the great value of that too-much-neglected institution. The elaborate plans for what is practically the rebuilding of the Academy have for some time been ready for active construction, and the three million dollars which, if everything proceeds favorably, will be available for the work, will clothe the beautiful and historical promontory on which West Point is located with a collection of buildings, which will not only form an admirable architectural group in themselves, but will adequately represent the national importance of the great military school.

Every well-wisher of his country will hail with positive delight this tardy appreciation of the claims of West Point. From the days of George Washington, who gave the initial impetus that led to the foundation of the Academy, throughout the first century of its existence, not merely has it failed to receive the encouragement from Congress which its importance and the splendid character of its work deserved, but it has been the subject of an indifference and neglect which posterity will find it extremely difficult to understand. Twice in the early period of its existence it was without graduates; in 1819 it was deprived of supplies of any kind whatever and was under the command, if you please, of a lieutenant; and in 1812 it was without either students or instructors, and remained in that condition some time thereafter. It was only the exigencies of the war of 1812 that saved it from extinction at the hands of the Secretary of War, who sought to strangle the already-enfeebled institution. Congress showed its hostility a few years later in an endeavor to extinguish the Academy altogether, and again it was the exigencies of war, in this case the war with Mexico, in which the graduates of West Point so greatly distinguished themselves, that prevented the closing of the institution. It is scarcely necessary to add that the great struggle of the civil war gave such indisputable proof of the value of West Point training as to insure the perpetuity of the Academy. Nevertheless, it is a fact that after the war Congress was so well leavened with men whose brilliant military records had been obtained in spite of the fact that they had no West Point advantages, that the hope of obtaining much-needed appropriations was destined to disappointment. However, now that Congress has decided to recognize the claims of the Academy, it is preparing to do so with no niggardly hand; and it is our conviction that generous as is the contemplated appropriation, it will ever be considered as among one of the most judicious and thoroughly merited distributions of the national funds ever made.

If the value to the nation of West Point needed any further demonstration, it is surely sufficient to point to the splendid service rendered by the officers of the Regular Army during and subsequent to the Spanish war. Had the entirely novel and extremely complicated problems that presented themselves with our acquisition of foreign possessions been left for their solution to the tender mercies of the political "carpet-bagger," the results in damage to our national prestige and in misery to our various new possessions would have been untold and irremediable. Fortunately, at the close of the war (in which the service of West Pointers was of that high character which the nation has always learned to expect and has invariably received), our Army officers displayed marked executive ability in the various, most complicated, and untried duties which presented themselves. The demonstration of West Point influence during the war, and in the solution of the problems which that war bequeathed to the nation, is an endorsement of our great military institution which, we venture to think, will insure for all time its generous treatment by Congress.

THE FLEETS OF THE WORLD.

The latest records of Lloyd's Register show that the fleet owned by the United States Steel Corporation has grown to such proportions that it now ranks as the fifth among the great steamship companies of the world. Considerably the largest of these is the Hamburg-American Company, which owns 134 vessels of an aggregate gross tonnage of 668,000 tons. The next largest is the North German Lloyd Company, whose 120 vessels aggregate 556,000 tons; the third company is the British Elder Dempster Company, which owns 153 vessels, aggregating 431,000 tons. Then follow the British India Steam Navigation Company with 122 vessels and 384,000 tons, and the United States Steel Corporation, with 113 vessels aggregating 343,517 tons. From the same source we gather that in point of total number of vessels owned and of their gross tonnage, the fleets of the United States stand second among those of the world. Great Britain and her Colonies, out of a total for the whole world (including countries possessing over one million tons of shipping) of 29,091 ships, aggregating 30,600,510 gross tons, possesses 10,869 with a total tonnage of 14,708,206 tons, one-seventh of which is composed of sailing ships. The United States owns 3,286 vessels with a gross tonnage of 3,077,344 tons, of which two-fifths are sailing vessels; and then follow Germany with 2,905,782, of which one-sixth are sailing vessels; Norway with 1,627,220 tons, one-half of which are sailing vessels; France with 1,406,833 tons, a quarter of which are sailing vessels, and Italy with 1,117,538, of which two-fifths are sailing vessels. While the lead shown by Great Britain is so great, strenuous efforts are being made by competing countries to reduce, by means of judicious subsidies, this great preponderance. Germany and France subsidize many of their lines heavily, and the policy has proved to be, particularly in the case of Germany, a wise one. The Ship Subsidy Bill now before Congress would very materially assist in the development of our merchant marine, discourage the purchase of foreign-built vessels and stimulate the shipbuilding industry on our own sea-coast. Contemplating the figures we have given above, there is much food for thought in the fact that about the year 1840, Great Britain possessed under 800 vessels whose aggregate registered tonnage was less than 150,000 tons, and that during this period the aggregate tonnage of the steamships owned by the United States was about 155,000 tons, or 5,000 tons more than that owned by Great Britain. That was in the days of wooden shipbuilding, and before the advent of steel, and more particularly before Bessemer steel, had given that wonderful impetus to British shipbuilding, the influence of which still enables her to maintain such a commanding lead.

THE COST OF AMMUNITION AT MANILA AND SANTIAGO.

An echo of the thrilling days of the Spanish war has recently been heard in a most interesting return made by Rear-Admiral O'Neil, Chief of the Bureau of Ordnance, U. S. N., in which he gives the total cost of ammunition in the decisive battles of Manila and Santiago. At Manila Bay the ships under Admiral Dewey fired at the Spanish ships and batteries at Cavite, $50,045 worth of ammunition, a remarkably low figure if we consider the momentous effect which that conflict had upon the operations of the war at large, and the fact that it was mainly instrumental in bringing the valuable Philippine Islands within United States control. At the battle of Santiago, the main batteries of the United States vessels fired 1,300 shots, and the secondary batteries 8,174 shots; the cost of the ammunition being about $80,000. The total cost of powder and projectiles of the naval operations in the Spanish war was only $175,000. As we showed in a recent article in the SCIENTIFIC AMERICAN, the gunnery practice of the North Atlantic Squadron costs considerably more in a year than the whole cost of ammunition expended in either of the important battles of the campaign, and herein is clear evidence of the great importance attached to good gunnery in the United States Navy.

REPORT OF THE PRUSSIAN COMMISSION ON AMERICAN RAILROADS.

Some two years ago the Prussian government sent to this country a committee of experts to investigate the methods of construction, equipment and management followed by the railroads of the United States. The investigation was carried out chiefly on the Pennsylvania system, which was taken as being thoroughly characteristic of the best methods in vogue. The chief of the Prussian Ministry of Railroads has stated that much has been learned from this scientific study of railroad conditions which are so fundamentally different from those upon which the Prussian system has been slowly built up. With regard to locomotive construction, the commission were favorably impressed with the American plan of building to standard sizes and using interchangeable parts—a method which is being gradually adopted on German roads. On the question of freight and passenger cars, the minister stated that, while the commission was favorably impressed with the large freight cars of from 40 to 60 tons capacity which are common in the United States, the existing traffic conditions were so different in Germany that such changes as were contemplated would have to be considerably modified to suit both the nature of the merchandise carried and the method of its distribution. The commission believed that while these huge cars were highly economical in the United States, where freight was moved in unbroken bulk over great distances, in Germany, where the total amount of freight and the bulk of each shipment is smaller, and the distances proportionately shorter, cars of 40 to 60 tons capacity would be out of proportion to the demands of traffic. This would be understood when it was borne in mind that, where a large number of small shipments have to be left at numberless local freight stations, it would be poor policy to drop a 40 or 60-ton car at a way station to unload a consignment of 8 or 10 tons of freight. At the same time, the standard 10-ton German freight car is to be advantageously replaced by double-truck cars of a maximum capacity of 30 tons. Enlargement beyond that limit would necessitate changes in track, platforms, and in the yard arrangements of mines, furnaces and other manufacturing plants that would be costly and generally inadvisable. It is probable that American practice in passenger cars will have less effect upon Prussian methods of the future than freight car practice is likely to have. The present model for long-distance service in Prussia is a vestibule car about 60 feet in length, which is divided into separate compartments and has a corridor extending along one side of the carriage. Although three standard Pullman American cars were brought to Germany for trial, and ran with great smoothness and absence of noise, they are not liked by the German public, who prefer their own system of smaller compartments with accommodations for six or eight passengers, in each of which a certain privacy, not obtainable in a Pullman car, can be secured. It is probable, therefore, that the Prussian state railways will continue to build their own type of standard passenger car and sleeper. The most popular type of the latter in Germany is divided into compartments, each containing an upper and lower berth and a separate wash bowl and water supply.

In the opinion of the German commission the American system of railroads is admirably adapted to the needs of a country like the United States, where vast distances are to be traveled, where there is the keenest competition between parallel and independent lines, and where the restrictions of caste do not exist. On the other hand, it is evidently considered that, in the main, the Prussian system, which has grown up through long years of development under state control, is pretty well suited to the needs of the German people. It has been slowly developed into an organization which pays over and above its operating expenses the entire interest on the Prussian debt, and also turns over an annual surplus of several millions to the public treasury. At the same time it must be remembered that the rates for freight and the first-class passenger fares are very high; the freight rates alone constituting a heavy handicap on agriculture and on many of the inland industries.

WIRELESS TELEGRAPHY AND THE PROMOTER.

There is one form of activity of our modern commercial life which, unfortunately, is as omnipresent as it is harmful and humiliating. We refer to that peculiar practice or calling, familiarly known as "promoting." Not that promoting is essentially an evil; for honestly conducted, and with a true regard for veracity, it is one of the most essential elements in the complex machinery of everyday commercial life. Without the promoter, indeed, many of the most valuable inventions would probably never have got beyond the theoretical stage, nor would our industrial development have reached its present marvelous proportions.

Unfortunately, the introduction of important inventions, and the securing of the necessary capital to exploit them, opens a lucrative field for the professional and none too scrupulous exploiter. So vast have been the fortunes realized from the great inventions of the past, such as the telegraph, the telephone, and the electric light, that the general public is strongly attracted, and properly so, to any invention which promises to have a wide field of application and to return generous profits to investors. It is unquestionable that there is a vast multitude of people, with a limited amount of money to invest, who, being naturally anxious to secure the very largest possible returns upon it, are powerfully attracted by any opportunity of acquiring interest in a new device that promises to be, to use the favorite term of promoting literature, "revolutionary" in the particular field that it covers; and it is upon the eager credulity of these people that the bogus promoter raises rich harvests of profit—for himself. We believe it may safely be said that the victims of this kind of fraud are rarely to be found among the people whose wealth entitles them to rank among the

capitalists; for the capitalist has his thoroughly trained experts at command, men who are retained at generous salaries for the express purpose of investigating schemes in which he is a prospective investor. Somebody once said that there is nothing so shy as a million of money, and nobody knows this better than the gentlemen who begin to scatter alluring prospectus literature broadcast, immediately upon the appearance of any well-authenticated invention that promises to catch the eye of the too-little informed and over-eager small investor.

The class of people who desire to get rich by "short-cut" methods has always been a large one, and it draws its recruits chiefly from the people of limited means who draw a weekly or monthly salary, and find it difficult to make the bank account cover the rather broad stretch of their social and other obligations. It is among this restless and over-eager class that the average promoter finds his most lucrative sphere of operations.

It is not so very many months ago that the SCIENTIFIC AMERICAN warned its readers against being led away by the exaggerated representations which were being made of the commercial possibilities of liquid air; and it seems now that on account of the brilliant accomplishments of Marconi, we are to have a revival of bogus promotion in its most objectionable and harmful forms. We do not for a moment question that wireless telegraphy has come to stay, and that it will play a most important part in the great world of telegraphic communication; but we are perfectly satisfied that it will by no means sweep out of existence the already established and most highly organized systems of communication by cable. Within the next few years we shall of course see powerful companies established for the legitimate exploitation of the new system, and no doubt there will be considerable profits accruing to those who have the good fortune to be associated with the properly organized corporations.

Unfortunately for the small investor, the prospectus fiend is already opening a vigorous campaign, and there are several concerns organized for the express purpose of relieving a more or less ignorant public of their money, by inducing them to invest, at anywhere from 75 cents to $10 a share, in so-called wireless telegraphy companies. The Editor has now before him a choice assortment of advertising literature, culled, most of it, from the daily press and current magazines, and much of it from pamphlets of the most alluring and up-to-date kind, which goes to prove that pure-minded philanthropy is not yet dead on the earth. There are corporations that are willing to take the public into their confidence, and for a nominal subscription of 75 cents a share are willing to let it reap the "golden harvest." Lest the reader should fail to grasp the magnitude of his opportunities, he is informed that within two or three days prices will be raised from 75 cents to a dollar; that the stock, in fact, will soon be selling in the open market at two, three, four or even twenty times its par value.

Now, there is no question but that ninety per cent of this literature is a tissue of lies, from its scare-head title page to its final announcement of the "make payable" address. And unless the public has learned well the lesson of the frauds which were perpetrated in connection with liquid air, the extraction of gold from sea water, and other famous prospectus swindles of the past few years, we much fear that there will be many an honest but foolish investor to whom the future mention of wireless telegraphy will come to have anything but pleasing suggestions.

RECENT MEETING OF THE NATIONAL ACADEMY OF SCIENCES IN WASHINGTON.

BY MARCUS BENJAMIN, PH.D.

The spring meeting of the National Academy of Sciences was held in the United States National Museum in Washington on April 15 to 18, with Dr. Alexander Agassiz presiding.

Prof. Henry F. Osborn, who holds the Da Costa chair of zoology in Columbia University, New York, was the first of the members to address the Academy, presenting a brief communication entitled Homoplasy and Latent Homology. At the last meeting of the Academy the subject of Potential or Latent Homology was discussed, especially as bearing on the independent origin of certain bones of the skull and other parts of the skeleton, as well as upon the cusps of the teeth, particularly the grinding teeth. It was shown that structures which are ordinarily considered analogous by comparative anatomists have not been derived from each other, but arise independently in different groups of animals, and this presents an interesting question as to how far these structures are latent or potent in the ancestral forms which have given rise to these different groups.

A second paper by the same author, entitled Evidence that North America and Eurasia Constituted a Single Zoological Realm During the Mesozoic and Cenozoic, and that Correlations can be established as a Basis for Uniformity of Geological Nomenclature, was then presented.

Prof. Edward W. Morley, of Adelbert College, Cleveland, Ohio, then read a paper on Determination of the Weight of the Vapor of Mercury at Temperatures Below 100 Degrees.

The next paper to be read was one on The Atomic Weight of Cæsium, by Theodore W. Richards, who fills the chair of chemistry in Harvard University. He began with a general discussion of the subject of atomic weights, and then passed to a description of his work on cæsium. The material on which the research was conducted came to him from Prof. Wells of Yale, and he established the fact that cæsium was an element, that the material on which he worked was pure, and gave as his result 132.878. This figure he checked by similar determinations obtained by using the nitrate, from which salt he secured results that averaged 132.877.

James M. Crafts, formerly President of the Massachusetts Institute of Technology, Boston, presented a summary of his recent progress in the admirable researches made by him on Catalysis. He referred in opening to the old theory of solution and similar chemical processes, and then passed to the more recent beliefs of the new chemistry. Formerly it was claimed that life could only be produced from life, but results are now obtained by the action of enzymes on chemical compounds that were believed formerly to be due to vital force. He then described the special results obtained by him during the past year. These were highly technical, and not susceptible of condensation for popular presentation.

The Significance of Changing Atomic Volume was the title of a second paper by Theodore W. Richards, and was a brief presentation of the recent theory on the construction of matter advanced by this brilliant young chemist; his contention being that atoms in chemistry are compressible. This subject he has already presented before the American Academy of Arts and Sciences in two papers, entitled, The Possible Significance of Changing Atomic Volume, and The Probable Source of the Heat of Chemical Combination, and a New Atomic Hypothesis.

On Thursday afternoon Alexander Agassiz presented his two papers, both of which embodied results of his recent expedition to the South Pacific Ocean. The first paper was On the Coral Reefs of the Maldives, in which he described the formation of these islands as consisting of numerous atolls, contending that the theory of subsidence, advanced by Darwin, was not satisfactory as an explanation of their origin.

His second paper, On the Theory of the Formation of Coral Reefs, was a more elaborate presentation of the subject, and in it he argued that the rims of the atolls had first been elevated, and on these rims the sand had found a resting place, leaving lagoons in the center. He referred to his finding large nodules of manganese, which he believed to be of volcanic origin, and his contention was that the atolls, the rims of which were of limestone or of coral formation, had been raised up by volcanic action as they rested on a volcanic foundation. In closing he referred briefly to the vegetation on these islands, most of which he thought had been brought by the agency of man.

William Sellers, the well-known engineer, then presented a paper on The Compulsory Introduction of the French Metrical System into the United States. He made an exhaustive review of the metrical system and its various features. He also reviewed the bill now pending in Congress making its adoption compulsory by the manufacturers and the merchants of the United States. Mr. Sellers declared that he did not favor the proposed law, for the reason that he believed it would work a severe hardship and injury to the manufacturing concerns of the country, and would seriously affect trade. He declared that he could not see any advantage to be gained from the use of the system in lieu of those now in vogue in the United States, and that, to his mind, the only difference was one in the standard of measurement, from the inch to the centimeter, and from the yard to the meter.

The next paper was on Psychophysical Fatigue, by J. McKeen Cattell, of Columbia University, in which he described the measurements of fatigue of the senses, of the muscular system, and finally of the mind itself. He illustrated his paper by means of small diagrams, in which he showed, for instance, how the eye became tired on examining a piece of cardboard in which part of the surface is practically darkened.

Prof. Edward L. Nichols, of Cornell University, then presented a paper On Some Optical Properties of Asphalt. When a thin layer of asphalt varnish is spread upon glass and allowed to dry, and some luminous source, such as the filament of an incandescent lamp, is observed through the film, it is found that a considerable amount of red light is transmitted, the unusual purity of which is readily ascertained by means of a spectroscope. The suddenness with which the rays beyond the red are cut off indicates the existence of a well-defined absorption band with a very steep gradient on the side toward the greater wave-lengths; and one would expect to find a considerable degree of perviousness in the infra-red and anomalous dispersion in the region where the change from transparency to opacity occurs. The purpose of his paper was to describe his studies in this direction, concerning which nothing appears to have been previously published. The paper in full will appear in the Physical Review for April, 1902.

The public session on Thursday began with the presentation by Charles S. Minot of a paper descriptive of The Physiological Station on Monte Rosa, by Henry P. Bowditch. It consisted largely of lantern slides taken at high altitudes, showing the construction of this new enterprise established in the Italian Alps under the direction of Italian scientists, but which, it was hoped, would pass under the care of an international committee of scientific men. The paper was a special plea for its recognition by the National Academy of Sciences. The lantern slides of the Alpine peaks were especially interesting, and received the well-merited applause of the Academy.

Charles S. Peirce followed with three papers, entitled, The Classification of the Sciences, The Postulates of Geometry, and the Color System, which, however, were read only by title.

The meeting was then practically turned over to the astronomers, and brief abstracts were presented by Asaph Hall of a paper on The Disintegration of Comets, followed by one of Ira Ibsen Sterner, entitled A New Computation of the Co-efficients of Precession and Nutation. Prof. Edward C. Pickering, of Harvard Observatory, presented briefly The Distribution of the Stars and The Variability in Light of Eros, both of which were highly technical, and were illustrated by means of mathematical formulas, which cannot here be produced. Several papers biographical in character were then read.

In the evening Prof. Charles F. Chandler, of Columbia University, delivered a lecture on The Electro-Chemical Industries at Niagara, in honor of the Academy. In that brilliant way, so familiar to those who have been so fortunate as to study under him, Dr. Chandler held an audience almost spell-bound for nearly two hours, during which he described the marvels of chemistry and the splendid results obtained at Niagara Falls by the application of electricity to chemical compounds. The tearing apart of the molecule of common salt, resulting in the formation of caustic soda and bleaching powder, which has come about from the inventions of his pupil, Hamilton Y. Castner, whom he described as a natural-born genius, were strikingly set forth, as well as the original invention of Castner, by means of which the aluminium industry was created.

SCIENCE NOTES.

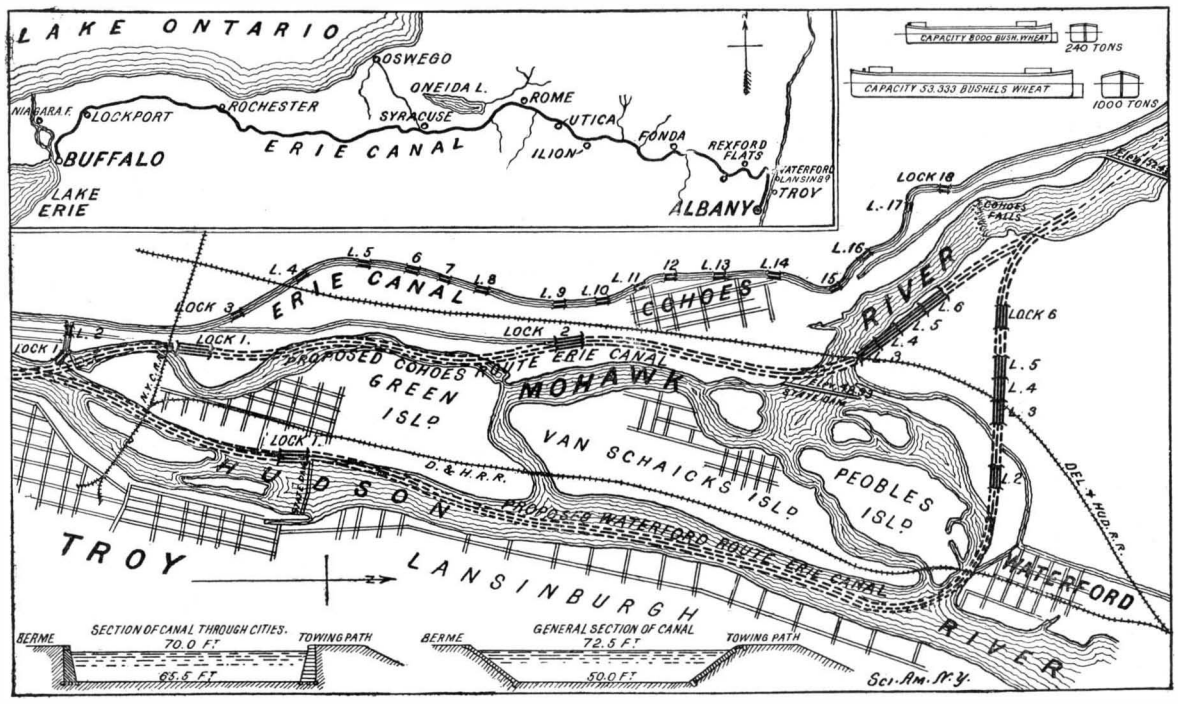
William Flinders Petrie, the distinguished Egyptologist, in an address to the supporters of the Egypt Exploration Fund, said that they had completed the most important historical work that had yet come into their hands, settling, in a manner which had hitherto seemed beyond hope, the very foundations of Egyptian history, says the Sun. No such complete materialization of history had been obtained by one stroke in any other country or age. He detailed the discoveries of the gold scepter of Nena, the founder of the Egyptian monarchy, gold vases and jewels of the same period, twenty engraved tablets and dozens of fragments of tablets, and 100 inscriptions on vases, giving more information of dynasties ruling 6,600 years ago than is known regarding half the Saxon Kings of England. The discoveries were all made in the neighborhood of Abydos, in ground abandoned as exhausted. The next work would be done on the site of the Temple of Osiris at Abydos, which was probably the burial place of the head of Osiris, which drew around it the burials of historic times and probably those of the earliest dynasties also.

Two-thirds of all the letters which pass through the post offices of the world are written by and sent to people who speak English, says Bradstreet's. There are substantially 500,000,000 persons speaking colloquially one or other of the ten or twelve chief modern languages, and of these about 25 per cent, or 125,000,000 persons, speak English. About 90,000,000 speak Russian, 75,000,000 German, 55,000,000 French, 45,000,000 Spanish, 35,000,000 Italian and 12,000,000 Portuguese, and the balance Hungarian, Dutch, Polish, Flemish, Bohemian, Gaelic, Roumanian, Swedish, Finnish, Danish and Norwegian. Thus, while only one-quarter of those who employ the facilities of the postal departments of civilized governments speak as their native tongue English, two-thirds of those who correspond do so in the English language. There are, for instance, more than 20,000 post offices in India, the business of which in letters and papers aggregates more than 300,000,000 a year, and the business of these offices is done chiefly in English, though of India's total population, which is nearly 300,000,000, fewer than 300,000 persons either speak or understand English.

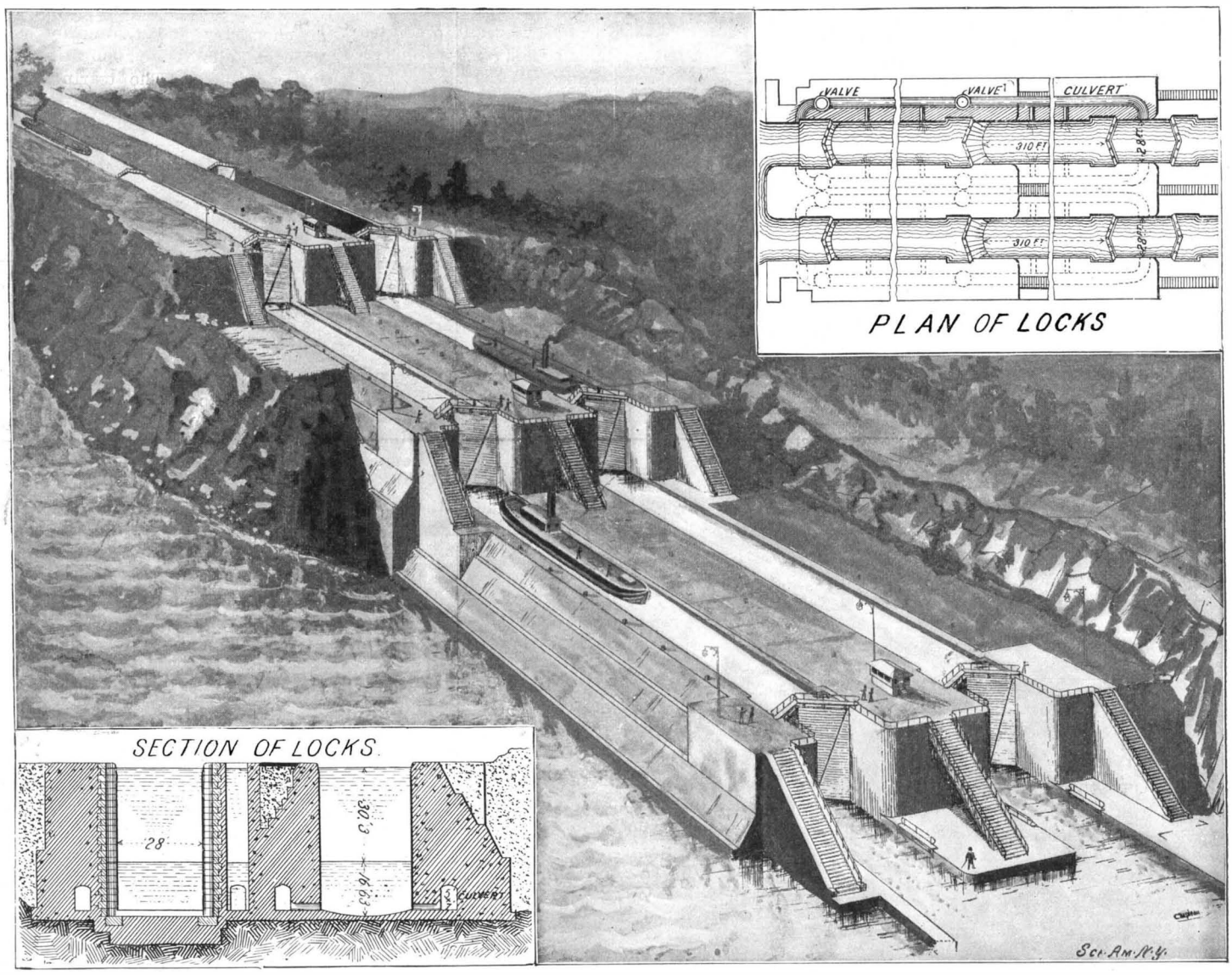
THE IMPROVEMENT OF THE ERIE CANAL.

The scheme for the reconstruction of the Erie Canal which is now before the Legislature is not to be confused with that larger and more costly scheme which was reported to Gov. Roosevelt and received his strong indorsement. The improvement as contemplated in that report included the reconstruction of the canal throughout its entire length, the abolition of the old system of locks and the substitution in their place of a system of mechanical-lift locks at Lockport and Cohoes, which were to overcome the difference of elevation at each of these places in a single lift. The canal was to be dredged out to a full depth of 12 feet throughout, and the estimated cost of the whole improvement was $60,000,000.

When Gov. Odell came into office the canal problem was probably the most important and pressing that came up for his consideration; and he made an early announcement of his belief that, owing to the strong opposition in the northern part of the State to the bill, it would be wiser to present a less ambitious scheme than that reported under the Roosevelt administration, in the hope of obtaining, by way of compromise, a grant for the immediate construction of the more essential features of the original plan, leaving the balance of the work to be carried out at a later date. The bill which is now before the Legislature has been framed in accordance with these suggestions. Briefly stated, it calls for an appropriation of $30,000,000, which is to be devoted to reconstructing the locks throughout the entire length of the canal, giving them a depth that will enable them to accommodate boats drawing 12 feet of water; and the relocation of the canal at one or two important points, and particularly at the easterly end of the canal in the neighborhood of Troy and Cohoes; and the digging of the whole canal to a uniform depth of 9 feet. The locks being rebuilt on the lines suggested in the original plan, the most important part of the work of reconstruction would be accomplished, and it would only remain to excavate the canal to a depth to match that of the locks to bring up the whole Erie Canal system to the high standard contemplated during the Roosevelt administration.



MAP OF THE ERIE CANAL, AND DETAILS OF THE PROPOSED RELOCATION AND RECONSTRUCTION BETWEEN TROY AND COHOES.



By these locks the difference of elevation between the Mohawk and Hudson rivers is overcome.

THE DOUBLE FLIGHT OF LOCKS AT COHOES.

As shown on the map, there are two alternative routes proposed, one known as the Cohoes, and the other as the Waterford route. The first named follows generally the south branch of the Mohawk River. There is a lock on the westerly shore of the river at the point where it is crossed by the New York Central Railroad; the second lock lies on the same shore at the crossing of the river by the electric railway, while the third, fourth, fifth and sixth locks are located in the elevated ground on the easterly shore of the river at Cohoes. The Waterford route, which is the one that will probably be adopted, follows along the Hudson to the State dam opposite the village of Lansingburg, then swings around to the north side of the Hudson, and enters what is known as the fourth branch of the Mohawk, opposite the village of Waterford, and following this branch along the north end of Peebles Island, it passes westward on a tangent across the country, ascending the hills by a series of locks and entering the Mohawk River above Cohoes Falls. From the Falls the canal follows the Mohawk River to Rexford Flats. On this portion the locks and dams are as follows:

Lock No. 1 is located at the south end of the present State dam at Lansingburg; Locks Nos. 2, 3, 4, 5 and 6 are in the rocky cliffs on the east side of the Mohawk River opposite the city of Cohoes; Locks Nos. 7, 8, 9 and 10 are in the Mohawk River between the Cohoes Falls and the Rexford Flats, and are situated at points where dams are necessary in the river to maintain the water at a proper elevation. A dam will be built at a point 300 feet above Cohoes Falls, at the same level as the present dam of the Cohoes Hydraulic Company, thus obviating any damages to that company caused by diversion of water. The general plan between Cohoes Falls and Rexford Flats provides for the formation of a series of pools in the Mohawk River and the locking of boats around the various dams. The dams proposed in the Mohawk River are mainly of concrete, with crests of sufficient length to carry the flood flows of the river without seriously flooding adjacent property. One result of the building of the dams will be that during the close season of the canals, from the 1st of December to the 1st of May, extensive water powers will be available at each of the dams. This power can be used by the State or leased to private parties for manufacturing purposes, as no water is required during those months for the operation of the canal. During most years there will be considerable water in the Mohawk River beyond the amounts necessary for operating the canal, which can be used for manufacturing purposes or the generation of electricity for trolley lines or lighting purposes.

The navigation of the proposed canal from Congress Street, Troy, to Rexford Flats will be steam, either by tugs or steam canalboats with consorts.

From Rexford Flats to Buffalo the proposed route follows the present line of the Erie Canal, except at a few points where a change in the location is necessary to ease sharp bends in the old alinement. At Cohoes the sixteen locks of the present canal are re-

placed by five locks; at Little Falls the four present locks are replaced by three enlarged locks; at Newark, the three locks of the present canal are replaced by one lock, and at Lockport the present five locks are replaced by three double locks. These and other changes in the number and type of locks reduce the total number on the entire canal, from the Hudson River to Buffalo, from 71 to 44 locks, making a decided reduction in the time necessary for passage of boats between those points, and effecting, of course, a material difference in the cost of maintenance and operation.

As we have already explained, the canal between Troy and Rexford Flats will lie almost continuously in the bed of the Hudson and Mohawk rivers, the change of elevation from one river to the other being secured by diverting the canal to the shore at suitable locations and building the locks in the rising ground. While the river presents more than sufficient width for canal purposes, it will have to be dredged to give the necessary depth. The section of the canal where it lies in the beds of the rivers will be 200 feet wide on the bottom, and must present at all stages at least 12 feet of water. The section on the Erie Canal itself will be that which was proposed in what is commonly known as the Nine Million improvement of 1895-6, and is shown in the accompanying drawings. In general this section is 50 feet wide on the bottom, with side embankments of 1¼ to 1, and a depth of 9 feet, except over aqueducts and permanent structures, where 8 feet of depth is provided for. The proposed improvement includes the cost of additional water supply for the summit level between Utica and Syracuse, which is secured by building reservoirs on various streams that lie to the south of the present Erie Canal.

From an engineering point of view, the most interesting part of the proposed reconstruction is the splendid flight of locks which is to be built at Cohoes to enable the canalboats to surmount the obstacle presented by the Cohoes Falls. The appearance of the locks is shown very clearly in the accompanying perspective view. The total difference of level between the Hudson and Mohawk rivers of 121 feet is overcome by three lifts of about 40 feet each, instead of the sixteen lifts which are necessary in the present canal on the westerly side of the river. The locks, which are built of concrete and masonry, are 328 feet long between the hollow quoins and 28 feet wide in the clear. The operation of locking is so well understood that it needs no detailed description here; but we may briefly state that the water is led from lock to lock by gravity through culverts which are built in the solid masonry, one on each side of each lock and parallel to its axis. These culverts are of the arched type, 5 feet in width and 7 feet in height. The water is led from the culverts into the chamber by means of two cast-iron pipes on each side. These pipes are 2 feet in diameter and 8 feet in length. The water supply to the culverts is controlled by butterfly valves at each end of the culvert.

The passage of a barge through the locks is as follows: After the barge has entered the first lock, the pair of miter gates behind it is closed, and the culvert valves are opened, allowing the water to flow from the first to the second chamber until it is at the same level in both. The miter gates separating the two chambers are then swung open, the barge passes through, the gate is closed behind it, and the second set of culvert valves is opened, repeating the process between the second and third chambers. These operations are repeated until the barge has passed through the whole series. The gates are of the type which has been used very successfully in the Canadian canals. They are 47.8 feet high, and with a full lock there will be a total pressure against each leaf of the gates of 607 tons. The gates are built of solid beams of timber, thoroughly well bolted together. Each beam is keyed to the next succeeding one, and iron rods extend through the whole from top to the bottom.

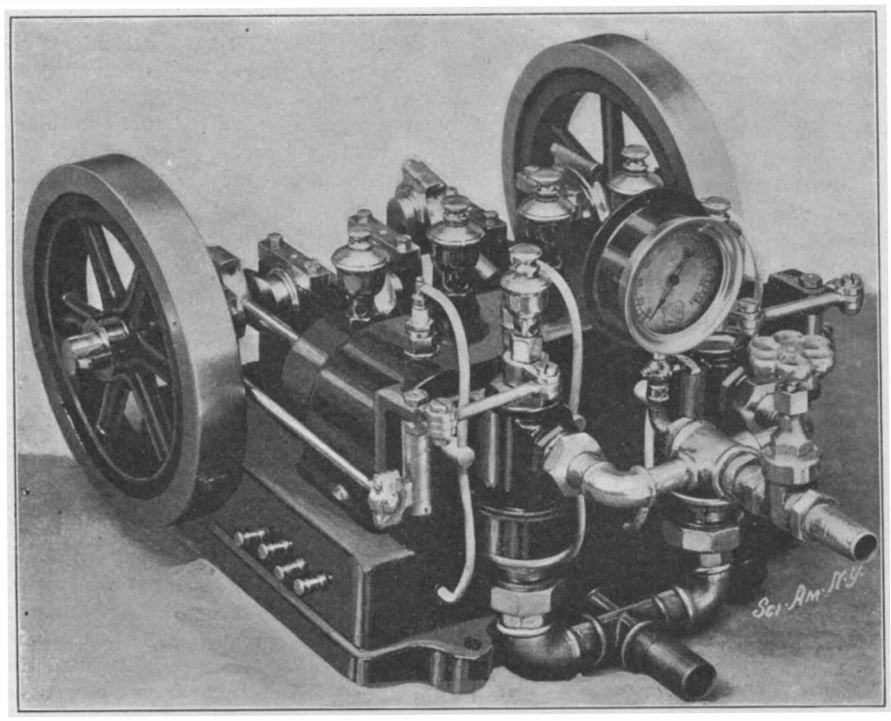
The enlarging of the canal to a depth of 9 feet and the lengthening of the locks will make it possible to greatly increase the size of the canalboats, or barges, as they will then be called. Instead of the present boats, capable of carrying only 240 tons of merchandise or 8,000 bushels of wheat, the canals will accommodate boats with a capacity of 800 tons or 30,000 bushels of wheat. Moreover, the time of transit from Buffalo to New York will be reduced from 430 to 400 hours, a saving of a day and a quarter, while it is estimated that the capacity of the canal will be increased from 3 1-3 tons an hour to 9 tons, about trebling the capacity.

A SELF-STARTING GASOLINE MOTOR OF NOVEL DESIGN.

The four-cylinder motor shown in the annexed illustration is the invention of Mr. G. Keller, of New York city. The motor is constructed somewhat similarly to a steam engine, and the adaptation of the principles of the latter to a gasoline explosive motor is the most interesting feature about it.

The gas from the carbureter enters through the main inlet pipe, on which is seen the throttle valve, and passes into each of the two valve chambers through simple, suction-lifted inlet valves, such as are found in any gasoline motor. It is then directed to one cylinder or the other by oscillating piston valves, the ports of which correspond with ports leading to the cylinders. These latter ports are also connected by the oscillating valves to the exhaust pipes seen at the bottom, when the pistons are on their upstrokes.

The oscillating piston valves that make this connection are operated by eccentrics on the motor shaft. One of these can be seen beside the right-hand flywheel, while the connecting rod of the other, with universal joint, is in plain view in the foreground. The sparking plugs are connected to two Splitdorf spark coils with vibrators, and the battery connections are seen on the base.



THE KELLER SELF-STARTING GASOLINE MOTOR.

The principle of operation of the motor is as follows: As the piston starts to descend, it begins to draw in a charge of explosive mixture. Electric sparks jumping across the gap at the spark-plug points continuously, immediately explode this gas, which drives the piston down. On the upstroke the burnt gas is exhausted, after which a fresh charge is drawn in and exploded as the piston starts to descend a second time. Thus it will be seen that we have practically a two-cycle motor that does not compress its charge. As the cylinders are four in number, 4 inches bore by 6 inches stroke, and as an impulse is obtained every one-quarter of a revolution, the motor will develop between 3 and 4 horse power at medium speeds, and will have a nearly constant torque. By compressing the gas in a small compressor (which can be located in the base of the motor) and introducing it under pressure to the cylinder, the same power can be obtained as from four ordinary two-cycle cylinders of the same size. The motor is light for its power, weighing complete about 150 pounds.

The motor, after it has been running a minute or two, can be stopped and started as often as desired, simply by switching off or on the electric current to the igniters. This was satisfactorily demonstrated to our representative by the inventor, who also ran two cylinders of the motor on gasoline and the other two on illuminating gas at the same time.

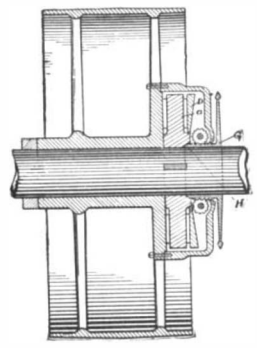
The motor can, furthermore, be run by steam or compressed air, and when so run is very powerful. A steam carriage equipped with a motor of this type would have an advantage over the ordinary vehicle of that character, in that, if the boiler should burn out, the operator could still proceed by connecting the inlet pipe of the engine to a suitable carbureter, and switching on the electricity to the spark coils and plugs.

The inventor has been four years in bringing the machine to its present state of perfection, and now makes it public for purposes of exploitation.

A GAS-ENGINE FRICTION CLUTCH.

There never has been a friction clutch absolutely faultless. The chief defects have been excessive cost of construction and inefficiency. The inventor of the friction clutch which forms the subject of the accompanying engraving has endeavored to provide a device which is intended not only to overcome the difficulties hitherto experienced, but which is also certain, easily handled, clean, self-contained, cheap, automatic, and self-adjusting. Arduous tests extending over some two years have demonstrated the efficiency of the clutch.

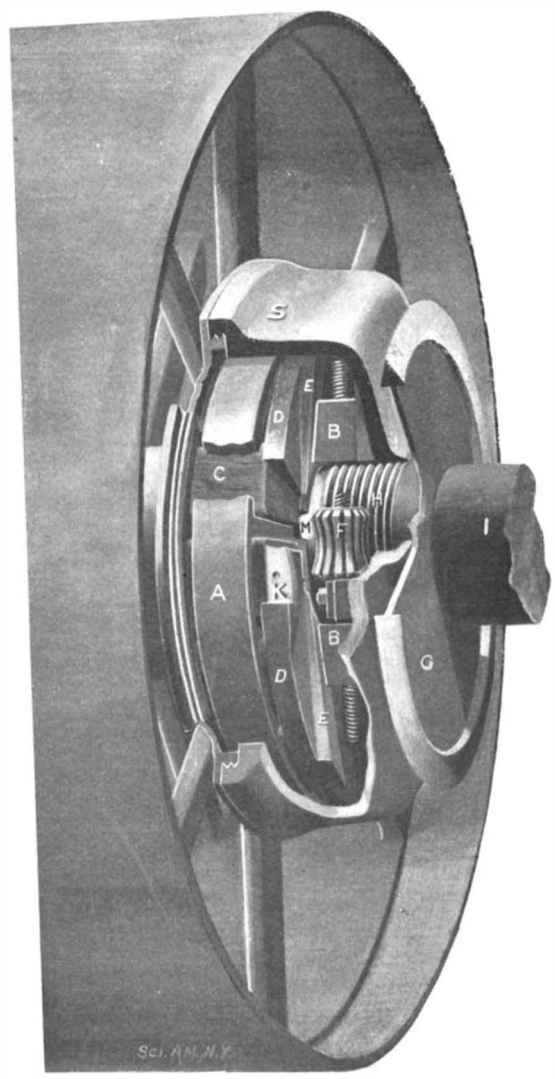
The gas-engine clutch, as its name implies, is peculiarly adapted for gas engines and clutch pulleys. In construction it comprises three principal parts—a crated disk or driver, *A*, containing the friction blocks; a pulley with a friction face-plate cast on the arms, to which the shell, *S* (Fig. 1), is secured by studs; and a starting plate or wheel, *G*.



PARTIAL SECTION.

The disk or driver, *A*, is keyed to the driving shaft. The shell, *S*, contains the worm gears, *F*, right and left hand screws, and wedge blocks, *B*, which work on the inclined planes of the friction plate, *D*. This plate is held tightly in place against the wedge blocks, *B*, by means of two coiled springs (not shown), and is carried around by lugs in the inside of the shell, which lugs fit into notches, *K*, on the edge of the plate. To the starting plate or wheel, *G*, a worm sleeve, *H*, is attached, having a bevel end, which end is in contact with the beveled opening of the crated disk, as shown in the diagram.

The starting and stopping mechanism comprises a lever (not shown), on one end of which is a small brake-shoe, formed with a V-shaped groove, fitted to the edge of the starting plate or wheel, *G*. On the outer end of the lever a sliding weight is carried. By moving the weight inwardly toward the clutch, the brake-shoe is caused to drop away from and to release the starting plate, so that the plate and worm sleeve will revolve with the shaft. The worm now turns the gears, and the resistance of the gears draws the conical end of the worm sleeve, *H*, into contact with the beveled opening of the crated disk, *A*, keyed on the shaft. This contact is sufficiently strong to turn the gears, *F*, and the right and left hand screws, thereby pushing the wedge blocks, *B B*, up inclined planes, *E E*, gradually forcing the friction plate, *D*, into contact with the wooden blocks, *C*, until the load is driven. The heavier the load the greater is the resistance of the gears; hence the conical end of the worm is forced into firmer contact with the beveled



THE PHILLIPS GAS-ENGINE CLUTCH.

opening in the crated disk, so that all the power needed to work the clutch is supplied.

As soon as the speed of the wheel is brought up to the driving member (which is the crated disk containing the friction block) the winding action of the worm sleeve ceases. Should the clutch slip, however, this winding action is automatically resumed.

No manipulation is required to start the clutch. As soon as the sliding weight is moved in, the brake drops away from the starting plate. Thereby the worm is released, which then runs with the shaft and begins to wind up the frictions. In order to stop the clutch, the sliding weight is moved outward on the lever; a slight additional pressure stops the starting plate and worm. The gears thereupon begin to turn around the stationary worm, reversing the direction of the screws and drawing back the wedge blocks, thereby releasing the friction blocks and stopping the clutch. The driving power of the device is claimed to be limited only by the strength of the material. The patents on the clutch have been acquired by Mr. Thomas Henry Smith, Jamestown, N. Y.

THE MANUFACTURE OF STEEL RAILS.

In the vast field of industry included in the operations of the United States Steel Corporation, there is none of greater importance than the manufacture of steel rails. For not only does rail-making call for the services of a great industrial army, but the steel rail has contributed more than any other cause to the rapid weaving of that marvelous network of railways which now covers every State of the Union. Its high quality and skillful design have rendered possible the great increase in power, weight and capacity of American engines and rolling stock, and a low cost of operation which is the wonder and despair of European railroad systems.

The celebrated Edgar Thomson Works, which are devoted exclusively to the manufacture of steel rails, are situated on the Monongahela River, a few miles from the city of Pittsburg. Here some 4,000 men are employed night and day in turning out steel rails at the rate of 5,000 to 6,000 every twenty-four hours, the rails varying in weight from 25 to 100 pounds per yard and in length from 30 to 60 feet, the average rail being 30 feet in length and weighing about 75 pounds to the yard. The 60-foot rail is something of a novelty, although it has been rolled in this length for several years. It is open to the objection that in northern States, where the range of temperature is large, the spacing of the rail-ends at the joints has to be so wide that it is difficult to preserve an even and noiseless rail-joint; hence, the call for 60-foot rails comes chiefly from southern States, where the range of temperature is small.

The first point of interest in these works is the stock-yards, which are laid out parallel with the long line of blast furnaces. Here are to be seen huge piles of iron ore, coke and limestone. The iron ore is brought from the company's iron mines in the lake district, being carried in the company's own ships to Conneaut on Lake Erie, where it is transferred by special ore-handling machinery to trains of pressed-steel ore cars, in which it is hauled over the company's own road to Bessemer. The trainloads of ore are brought into the yard and run on to a trestlework, where the hopper bottoms of the 50-ton cars are opened and the contents dumped on the stock heap. The coke is brought in from the great Connellsville coke region, and the limestone, which is used in the blast furnace for a flux, is brought from the quarries at Tyrone. As showing the scale on which the Edgar Thomson furnaces are operated, it may be mentioned that there are in these works no less than fifty miles of standard gage track, and that in twenty-four hours' time there is consumed in the furnaces 200 carloads of ore, 175 carloads of coke, and 75 carloads of limestone.

The blast furnaces, of which there are nine, are massive cylindrical structures of brick and steel, each about 90 feet in height and of varying external and internal diameter. The mouth of the furnace has an internal diameter of 15 feet, which increases in the first 60 feet of its depth to a diameter of 20 feet, the increase being given to allow of an easy descent of the charge as it is reduced. The wall is 3 feet in thickness, and its weight is borne upon a circle of massive cast-iron columns. From its largest diameter the furnace tapers down to a diameter of 12 feet at the point where the hot-blast tuyeres are introduced, and from these tuyeres to the bottom of the furnace it is cylindrical in form, the diameter here being 12 feet throughout. The walls are built of brick with an outer casing of sheet iron and an inner lining of firebrick. The upper 60 feet of the shaft is called the body; the lower, tapering portion, the bosh; and below this is the hearth or crucible, into which the molten iron collects and from which it is tapped off. In the earlier days of steel manufacture, the furnace gases were allowed to escape into the air, but now the mouth is closed by a cast-iron bell which is opened only when a fresh charge is to be introduced. The confined gases are led from the top of the furnace by a large wrought-iron pipe, and conducted to a set of four hot-blast stoves, which are about 20 feet in diameter and 90 feet in height and have their interior filled with a mass of honeycombed firebrick. The hot gases are ignited at the base of the stove by the admission of a proper amount of air, and the hot products passing through the firebrick raise it to a high temperature. When the proper degree of heat is reached, the gases are turned into the next stove, and the cold-blast from the blowing engines is turned in at the bottom of the heated stove, and passing up through the brick work, absorbs the heat therefrom, and issues at a temperature of 1,300 to 1,400 degs. Fah. The difference between the temperature of the cold-blast and the issuing hot-blast represents the heat which is saved from the gases and restored to the blast furnace. The heated air is introduced at the bottom of the blast furnace through a number of water-cooled tuyeres. The raw coke, limestone and iron-ore are carried up to the charging platform of the furnace by means of electrically operated elevators, and the charging goes on continuously. Under the fierce heat of the hot-blast, the charge is maintained in a state of reduction almost to the top of the furnace, and when the material finds its way in the form of slag and molten iron to the bottom of the furnace, it is drawn away, the slag being tapped off from the top of the hearth and the molten metal from the bottom or crucible. From the time of putting a charge in at the top of the furnace to the time of drawing off the metal, is ordinarily about thirty hours. The slag is drawn off into trains of massive iron ladles, which are mounted on trucks running on a broad-gage track. These ladles, which have a capacity of 10 tons, are nicely balanced on trunnions, and are easily tipped for unloading the slag, which is at present being used for filling in the low ground on the property of the Edgar Thomson Works.

The molten iron is tapped into 17-ton ladles, which are drawn in trains of five or six to another part of the works, where their contents are poured into the metal-mixers. These latter are large, oblong iron boxes, each of which has a capacity of 175 tons. The train of ladles is drawn on to a raised track, where each ladle in succession is brought opposite the mixer and its contents poured in. The object of the mixers is to bring the mass of molten metal to a uniform temperature and quality, since the iron from one furnace may vary from that from another. The mixers are kept full all the time, and the contents are continuously being poured out by the tipping of the mixer into other 17-ton ladles in which the mixed metal is carried to the Bessemer converters.

The converter is a huge egg-shaped vessel built of heavy wrought-iron plate, lined internally with refractory materials and carried on trunnions, one of which is hollow and serves to conduct the air blast to the bottom of the converter. Here there are fifteen or twenty tuyeres of fire clay, each of which is perforated with a number of ¾-inch holes. By this arrangement between 150 and 200 separate streams of air are forced up through the body of the molten metal during the process known as the "blow." The converter charge is about 15 tons. When the blast is turned on, the air rushes up through the body of the metal, and its oxygen combines with the carbon, silicon, manganese, etc., in the iron, the combustion of these elements serving to raise the temperature of the metal until it reaches the stage known as the "boil." The process is carried on for 15 or 20 minutes, until all the impurities are burned out and only pure, or practically pure, iron remains. The blast is then shut off, and the charge is emptied into a 15-ton ladle. At the same time a certain amount of molten spiegeleisen is poured into the ladle with the iron, the proportion of spiegeleisen being such as to introduce into the metal the proper amount of carbon and manganese for the quality of steel rail that it is intended to roll. The ladle with its 15 tons of molten steel is placed on what is called the pouring stand, underneath which runs a small railway on which are trains of cast-iron ingot molds, each truck or car carrying two of the molds. The pouring ladle is provided with a nozzle and stopper in the center of its dome-shaped bottom, the discharge of the metal being regulated by a lever at the side of the ladle, as shown in the accompanying illustrations. The ingot molds are drawn by hydraulic power successively beneath the ladle and filled. After the ingots have set, the train of molds is hauled out to the yard and stripped, then the ingots are immediately taken to the pit-heating furnace, or the "soaking pits" as they are called, where they are heated for rolling into "blooms." These ingots are of the proper composition of steel required for the particular quality of rail which is being rolled, and they constitute what might be called the raw material of the rail-making department, an illustrated description of which will be given in a later issue.

The curious ice caves of northern Arizona have been found to be apparently inexhaustible mines of ice. A company has been organized to mine this ice.

Engineering Notes.

A method of utilizing boiler-furnace clinker adopted at some works near Rouen has the threefold advantage of turning to account a waste product, the cost of removing which is considerable, of separating for further use the particles of incompletely-burnt coal, and of affording, with very little labor, a building material equal to brick or the best limestone. The treatment consists in a picking out of the coal particles, a breaking for reducing the pieces to the size of a nut, mixture of the substance with slaked lime, molding the paste thus obtained into bricks, and finally their drying.

When railroad tracks are laid over marshy ground or on an uneven roadbed, the fishplates become loosened, and the rails work up and down. This movement of the rails results in the battering of the ends and the rounding of the corners, thereby destroying the rail, which must be discarded long before the body is worn out. For the purpose of preventing the battering of the ends of the rail, Mr. W. E. Coyan of Homestead, Penn., has devised a rail, only the ends of which are hardened. Mr. Coyan attains his result by treating the rails when hot with a case-hardened fluid, and then with a tempering fluid.

Consul Winslow, of Liege, reports the discovery of a soft-coal basin at Asch, in the province of Limbourg, a few miles to the north of Liege. The coal much resembles that found at Westphalia, Germany. It contains from 18 to 20 per cent of volatile matter. The first vein was discovered at a depth of about 1,640 feet, and between this and 1,968 feet five veins have been discovered, ranging from 2.6 to 6.6 feet. It is thought that this basin covers about 24,700 acres. A German company from Westphalia has begun to develop a mine, and the John Cockerill Company, that has extensive mills at Seraing and shipyards at Antwerp, has decided to build large works in the basin.

The experiments which the British Admiralty have been carrying out for some time past with the Temperley-Miller marine cableway, for coaling warships while traveling, have been attended with so much success that it has been decided to send the collier "Muriel," which was equipped with the apparatus specially for these tests, to sea with one of the fleets. A cableway approximately 400 feet in length was stretched between the collier and the battleship "Trafalgar," which took her in tow. While traveling at from seven to ten knots an hour the battleship was coaled at an average rate of thirty tons an hour. When the distance was decreased a maximum rate of forty tons an hour was reached.

A new line of refrigerator steamships for service between this country and Great Britain is to be established. The new line will be controlled by a British-American syndicate. The boats will run with weekly sailings from Bristol. One line will travel between Bristol and New York, a second between Bristol and Boston; and a third line between New Orleans and Bristol. The principal purpose of the third is to facilitate and expedite the transit of the Californian produce to the English markets. The railroad runs from California to New Orleans will be two days shorter than to New York. Fruit will be carried over the Texas Pacific & New Orleans Railroad. A great warehouse is being built at Bristol containing 1,000,000 feet of space, capable of storing 12,000 to 15,000 tons of general produce. Already an extensive cold storage plant has been erected. New docks are being constructed, and several improvements with the existing accommodation are being carried out, at a cost of over $5,000,000. This project is the outcome of the recent visit of the British manufacturers to this country.

In view of the spirited competition British manufacturers are encountering at the hands of foreigners, they are displaying a keen enterprise in drawing attention to their goods. During the present year there will be no less than five industrial exhibitions held on a large scale in various parts of the country. Owing to the coronation festivities, there will be a large influx of foreigners to Great Britain during the coming summer, and British manufacturers intend to avail themselves of such an opportunity to the fullest extent. The largest and most important of these trade exhibitions will be that which is to be celebrated at Wolverhampton. It will cover ten acres of space for the display of exhibits, which are coming from all quarters of the globe. The exhibition will be modeled to a great extent on that recently held at Glasgow. The erection of two great central halls is now in progress. One is to be of the Palais de l'Industrie type, measuring 376 by 148 feet; and the other is being built on somewhat similar lines to the Paris Trocadero, and covering 348 by 128 feet. These two buildings have a combined superficial area of some 100,000 square feet. Another important exhibition will be the Australasian Exhibition to be held at the Royal Exchange. The American Exhibition to be held at the Crystal Palace will occupy some 800,000 square feet, while in Ireland the Cork Exhibition, judging from the strong support it is receiving, promises to be a success.

Correspondence.

American Officers for American Ships.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 25 I see an article upon "Scarcity of Officers in the Mercantile Marine," liable to occur by the increase of our navy, and a plea to facilitate the admittance and passing of candidates for officers' licenses. I beg leave to differ with the writer of your article in two regards, and at the same time note a protest against the facilities with which in some ports officers are "fabricated."

First: In the United States mercantile marine you have now many good and able men who would gladly pass and become officers if the cause of my protest did not exist.

Second: One or two years more in age demanded will not debar the young men of our country from adopting the profession, and will besides adapt them better to command subordinate sailors who have been following the profession for ten to thirty years. Also the risk of shipowners to place persons in charge of their valuable properties, not to mention the lives of passengers, will be lessened by having officers of the age of men.

Now my protest: There are firms on the west coast of the United States (mostly British), and principally in Seattle and Tacoma, who prefer officers of their own nationality on their ships, which happen also to be the larger and better ones.

They or their British captains have imported and still import British subjects from Hong Kong, have them made United States citizens "to order," or have them swear to be born somewhere in the East and carried "home" to Great Britain at a tender age by their parents.

The next move is to have these men make an application for a *master's license on any ocean, unlimited*, and get it signed by two shipmasters; this they take to the local inspectors with a letter of recommendation, and although they can show no license of any inferior rank nor any proof that they sailed previously on any American vessel, are examined and receive illegally such superior master's license, and get forthwith employment from these English shipowners. Consequently the young men of the country and other good and capable American officers are debarred from positions which otherwise they might occupy.

The Great Northern Railroad is building some very large boats now, and the writer knows of several officers (British) of the N. Y. R., a Japanese line, who have been fabricated United States mercantile marine officers in Seattle, who have never sailed under the United States flag nor were born in the East and carried home when young, and who have applications in for positions on these steamers. If well recommended, they will perhaps take the places which United States citizens should occupy.

The "Harbor," an association of United States licensed masters and pilots of steam vessels, 318-9 Globe Block in Seattle, and the one in the Ferries Building, San Francisco, have for some time been fighting this nefarious business, but so far without apparent result; perhaps because not enough publicity has been given to the cases.

Both harbors can give anyone much more information if desired. JOHN DOORN.

Yokohama, Japan, March 20, 1902.

The Extermination of Mosquitoes and Prevention of Malaria.

BY HENRY CLAY WEEKS.

The following are a few conclusions reached concerning the mosquito plague:

I. Every mosquito found in a district is an indictment against the public spirit, the progressiveness, the intelligence or the persistence of the people of the district, except in instances so rare as not to affect the statement.

II. Every case of malaria, not a relapse or an importation into a district, is evidence of an avoidable crime against humanity in some or all of its interests and against the fair fame of some of the most beautiful sections of the land.

III. That in greater degree than smallpox is malaria a crime, for the latter reaches more persons and its effects are more pervasive. Some high authorities are urging the imprisonment of smallpox patients as criminals.

IV. Mosquitoes are the intermediaries in spreading malaria between malarials and healthy persons.

(The most recent of the now numerous confirmations of this thoroughly established conclusion comes from the progressive Japanese: a battalion of soldiers in Formosa was completely protected from mosquitoes for 161 days during the malarial season. It entirely escaped the disease. An unprotected battalion at the same place had 259 cases of malaria. The New York Times, commenting on the case, emphasizes the necessity of beginning energetic campaigns against mosquitoes in every place where malaria is prevalent. Indeed, to do so is a duty rather than a need. Malaria is a most insidious disease, even in its milder forms, and the annual toll which it has exacted from humanity has been enormous. To conquer it would be to increase several times the habitable portion of the earth's surface.)

V. That to improve a section by banishing malaria and in many other ways, mosquitoes must be exterminated.

These conclusions, it is considered, are deducible by all minds open to conviction who have the opportunity of reading a book just issued by the North Shore Improvement Association, whose membership at present extends from Lloyds Neck to Sands Point, L. I., New York. At great expense, for the last six months, a committee of this association has been working indefatigably upon the subject of exterminating mosquitoes from their territory, following out the purposes of the association, as shown in its name. Several specialists have been engaged and have prepared exhaustive reports on the conditions and the methods and cost of relief. A map 41 x 58 inches, showing the danger points of the territory and the kinds and extent of mosquitoes found, has been made from actual surveys and from latest government authority; Prof. N. S. Shaler, of Harvard University, has reported on the marine marshes and related subjects; Prof. Davenport and Mr. Lutz (biologist), of the University of Chicago, each with an assistant have made an entomological survey, and an engineer in economics has made a complete examination of the 75 square miles to determine methods, etc. The results, together with a brief account of the successful Center Island (Oyster Bay Harbor) work, are now in the shape of a printed report of 125 pages, with accompanying maps, which it is the intention of the committee to shortly place in the hands of the representative persons and societies of the district.

Dr. L. O. Howard, the Chief Entomologist of the Department of Agriculture, has read and endorsed the plans, and his letter to the committee is inserted as an introduction.

It is the firm belief of the writer, gained from actual experience, that this most charming section of Long Island can be freed from mosquitoes within a year and that—what is even more important—malarial diseases can be successfully driven out as a result, together with other material benefits as explained in the reports.

As the time, however, for beginning action for this season's relief is at hand, a few practical suggestions for domestic situations, not fully covered by the book, are given here:

1. Each season's crop of mosquitoes comes from a very comparatively few gravid females which hibernate in cellars, under the covers of cisterns and cesspools and like warm places. Every single one of these destroyed means a proportionate reduction in the output. If *all* could be destroyed in a given section in the early spring it would be practically free. The suggestion is for each householder to give an hour, *at once*, to this work. The fumes of petroleum are destructive. Place some in a cup and hold it beneath them and they will fall into it stupefied. If they are at the ceiling fasten the cup on a stick. In cesspools and cisterns spray a cupful along the sides and ceiling of each. If difficult to get at the cesspool pour a larger quantity down the waste pipes, enough to create destructive fumes. Spray all sheltered places where any pests are seen or suspected. Kill every one that is seen early in the season.

2. By or before May 1 there should be thrown into the cesspools and cisterns (or rain barrels) about a half pint of kerosene (for the largest surfaces). It is safe to declare that the mosquito seeking water wherein to lay eggs will find an entrance into 99 out of every 100 such places claimed to be tight. This should be repeated until September 15, and later if warm, at least every two weeks. Thus at a cost of a little attention and an outlay of less than ten cents for oil, each householder may do his or her share to reduce the pest. The report emphasizes the fact that each house is responsible for the mosquitoes that infest it and its neighborhood, also that oil need do no damage to the water of cisterns and rain barrels.

3. The splendid work that has been done by the authorities in the eastern hemisphere and to a limited extent on this, in eliminating mosquitoes and with them malaria, contemplates the destruction by officers of the law of all useless receptacles of water, as old cans, pans, open bottles and the like on private and public grounds. And this work is what is necessary *at once* to be done by the town boards of health or other officers in this or any district.

4. Other work pertaining to individuals or officials, as clearing drains, etc., is indicated which could be deferred to May 15 if the season keeps cool.

5. The larger work of abolishing breeding places in marshes, of draining ponds, pools, streams, roadsides and the like are all thoroughly treated.

It is hoped that the philanthropic publication of the North Shore Improvement Association will lead many communities to take up this work and carry it forward until public interest demands that this shall become a public work as much as the extirpation of any other plague.

Automobile News.

Out of the twenty-seven entries received by the Long Island Automobile Club for its 100-mile endurance run on the 26th, fourteen are for gasoline carriages, twelve for steam, and one for electric. It is expected that many more entries will be made, and it is probable there will be altogether some fifty automobiles in the run. From present indications, it would appear that the gasoline and steam types are to be about evenly represented, while the electric vehicle will only be upheld by two or three pioneers in long-distance work.

The inhabitants of Porto Rico seem well inclined to the automobile, a machine which, until recently, was almost unknown there. An agent of an automobile company states that he has been able to sell some $20,000 worth of vehicles to Porto Ricans. According to the Automobile Magazine, the vehicle in the Philippines promises to play an exceedingly prominent part in the development and cultivation of our recent possessions.

An automobile made in Paris, which serves a mine in Peru 11,166 feet above sea level, had to be subdivided into parts not weighing more than about 66 pounds each, so that they could be carried on mules' backs. Three times a week the vehicle makes a run of 12 miles between the mine and Tarica, on gradients frequently attaining 1 in 8, states the Auto-Velo; and at first some difficulty was experienced through water boiling at 185 deg. Fah., on account of the altitude.

A new type of pneumatic tire for automobiles called the "Martin" has been undergoing severe tests in England. A car with its wheels equipped with it has been running between London and Brighton. Even upon light vehicles, the strain upon the tires is very severe, causing incessant trouble. One salient feature of the Martin pneumatic tire is that the inventor dispenses with the inner tube, which is responsible for the majority of tire mishaps. The Martin tire consists of a band built up of a road surface of thick rubber, with inner layers of fabric and thin coatings of rubber, the whole vulcanized together. This band is moulded to an arch shape and becomes a tire in conjunction with the felly of the wheel, to which it is fastened by flanges on either side gripped together by bolts passing through the wooden felly. When these bolts are tightened the cover is gripped on each side between the flanges and the felly, establishing an air seal, the security of which is increased by the fact that the flanges and fellies are both serrated. By this means the tire is held very firmly to the rim, and it cannot creep. It will be immediately realized therefore that it is not a handy tire to remove for repairs, but the severe trials to which the tire has been subjected during the runs between London and Brighton prove that a genuine puncture is very unusual, and as there is no inner tube, internal troubles cannot arise. Another strong recommendation is that it does not roll, and it is resilient.

A motor omnibus service is to be inaugurated in Birmingham, England. Experiments with a self-propelled vehicle of this character were made a short time ago to ascertain the specific points which should be incorporated to render a motor omnibus satisfactory and reliable with, at the same time, a minimum weight. The result of these trials has been the designing of an entirely new car and motor, the only outside mechanism being the Hans-Renold driving chain. The vehicle will be capable of seating sixteen passengers inside and six out, with seats for the driver and the conductor. It will be fitted with an adjustable cover, which may be removed in fine, summer weather. The seats will be set obliquely across the car, a gangway being left down the center, and each seat will be armed off. The engines, of 20 horse power, are suited for petrol, heavy petroleum, or compressed gas, or a combination of these fuels, but the projectors intend to burn heavy oil in conjunction with coal gas, as heavy oil is of great calorific power, is considerably cheaper than petrol, and has a high flash point. The machinery is thoroughly protected from mud and dust, and the four-cylinder engine is so arranged that the reciprocating parts are balanced and vibration avoided. Each of the four cylinders is under separate control, and the gearing allows for about ten combinations. The engine is water-cooled, and the exhaust from it may be optionally used for heating the interior of the vehicle in cold weather. The car is supported on the driving wheels by means of a balanced beam spring, with a view to lessening vibration, thus enhancing the comfort of the passengers and diminishing the wear and tear. Solid rubber tires are provided to the wheels, and the omnibus, which has a total weight when fully loaded of about three and a half tons, is designed to travel at twelve miles an hour.

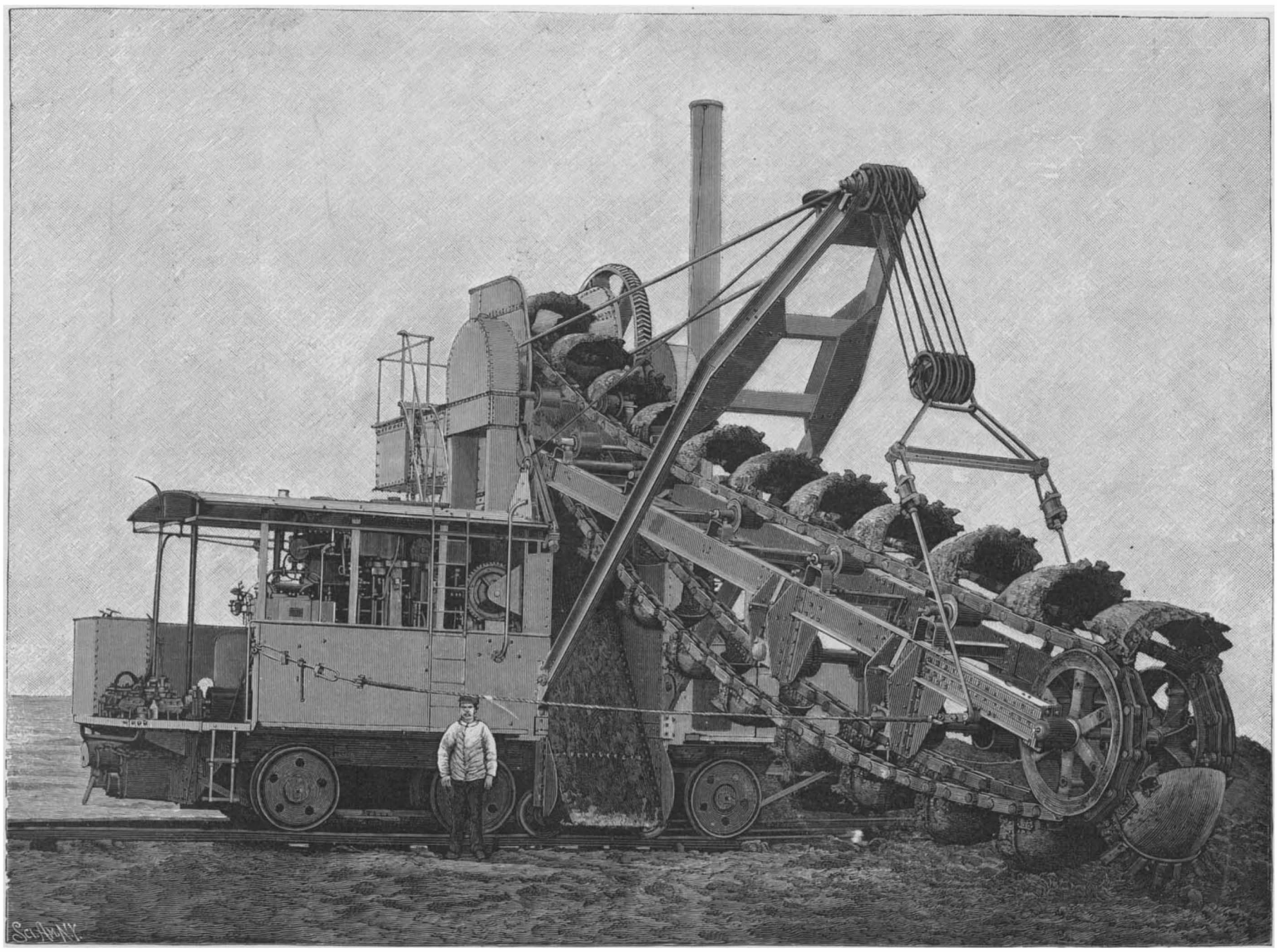
A CANAL EXCAVATOR FOR JAVA.

Messrs. Smulders, the well-known dredger engineers of Amsterdam, have recently completed the construction of a large canal excavator for the Netherlands Colonial Department for the irrigation works of the Solo Vale, Java, Danish East Indies. This excavator, a model of which is at present on view at the Paris Exhibition, is designed to excavate to a depth of 16 feet below the rails along which it travels. If the exigencies demand it, however, it can be operated with a jib, when its range becomes 36 feet in width by 15 feet in height. It has been specially constructed to work the peculiar soil of Java, which somewhat resembles a marl. When dry this earth is exceptionally hard, almost solid like rock, but when wet it is extremely sticky. It will be immediately realized, therefore, that excavation in such soil is a difficult operation under any conditions, and in order to satisfactorily perform the work the appliance has been constructed of unusual strength. The teeth to the buckets are not only provided with sharp points, but are also supplied with a sharp cutting edge, so that the marl may be readily disintegrated, whether it be hard and dry, or wet. When the soil is wet and sticky, the teeth of the buckets are apt to become clogged, but the marl is easily discharged from the buckets when in this condition.

The excavator travels along a broad railway track, so that the buckets may be brought to bear upon any point that the engineer may desire to excavate. The appliance is supplied with four engines: 1, the main engine for actuating the bucket chain; 2, the engine for propelling the excavator along the railway track; 3, the engine for hauling the ballast wagons; 4, the engine for raising and lowering the bucket arm.

The maximum capacity of the excavator is about 30 buckets per minute, which is equivalent to a displacement of about 4,000 cubic feet of earth per hour. Of course, the excavating capacity depends upon the condition of the soil upon which it is working, but from the trials a speed of from 20 to 30 buckets per minute can generally be maintained.

The body of the excavator consists of two heavy longitudinal built-up girders, connected by transverse beams, between which are fixed auxiliary longitudinal girders. The upper face of the frame is covered by a roughened plate at a height of 3 feet 6 inches above the ground. This frame rests upon four axles, three of which carry three wheels each, while the fourth has only two wheels, but in place of the third wheel is supplied with two small wheels which can be employed as an additional support if necessary. The frame is suspended on springs, and is also fitted at each end with buffers and coupling chains for the attachment of the ballast wagons. The excavator travels upon a track, the gage of which is 71.16 inches and consists of three rails, two of which are laid at a gage of 44 inches. The staff necessary to control the excavator consists of the engineer, fireman, and a man to operate the buckets and to load the wagons.

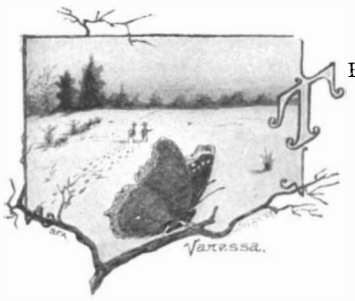


A CANAL EXCAVATOR FOR JAVA.

Assyrian Statuettes, Analysis of Metal.

M. Berthelot has lately made a series of analyses of the metal contained in a number of the statuettes of the Louvre, especially those belonging to the Assyrian collection, and has given his results in a paper read before the Academie des Sciences. It was found necessary to bore out the statuettes at the base so as to fix them upon a support, and this afforded a certain quantity of metallic powder which M. Heuzey, the archæologist, gave to the author to be analyzed. The first of these statuettes represents a woman sustaining a basket upon her head with both arms, and measures eight inches high. The lower part of the body is covered with a garment upon which are a number of inscriptions. The body has no legs, but terminates in a point. This kind of figure has been a current type from the time of Goudea down to that of the king Rim-Sin, covering a period of twenty centuries. The figures seemed to have served as amulets which were buried in the foundations of edifices. The present specimen bears the date of Bour-Sin, a Chaldæan king of the city of Our, near the 26th century B. C. Its color is copper-red and it presents a double layer of incrustation on all parts of the body; the first layer is superficial, of greenish color, and is scaled off in places, while the second is deeper and more uniform, of a reddish color. Several analyses of the metal were made, the first upon a powder extracted at 1½ inches deep in the vertical axis, which had a reddish-white metallic look. This gave, for 100 parts, copper, 76.0; lead, 18.1; sulphur (in considerable proportion), iron and oxygen, 5.9 parts. As this composition was unexpected, the author made a second analysis of a compact fragment, reddish in color, detached from the tail of the statuette, and found copper, 77.4 parts; lead, 17.0; sulphur, 2.3, with a little iron. This confirmed the preceding analysis, with slight differences. The surface layer contained carbonate of copper, with oxidized lead and iron. Thus the statuette consists mainly of an alloy of 1 part lead and 4 parts copper with considerable sulphur, which no doubt came from the native mineral used. This composition contrasts with that of the ancient statuettes of Goudea and Our-Nina, which consist of nearly pure copper, and differs also from a figure of the date 2200 which was previously analyzed and found to contain nearly pure copper. This led to a re-analysis of this latter, with metal taken from the center of the figure, and it gave copper, 95.7; iron, 3.1; sulphur and oxygen, 1.2 parts, showing that it was nearly pure copper. The next analysis was made upon a Babylonian figure of unknown date. It represented a priest or divinity, bearded and wearing a tiara, holding an animal on its breast. The metal was of a reddish color, and the metallic powder obtained seemed to be mixed with carbonate of lime. The analysis gave the following proportions: copper, 79.5; tin, 1.25; iron, 0.8; oxygen, 9.75; carbonate of lime, 8.3 parts. This metal was very much oxidized. The author next analyzed the metal taken from the pedestal of a small Babylonian bull having the appearance of bronze, with silver incrustations. It contained the following: copper, 82.4; tin, 11.9; iron, 4.1; oxygen and residue, 1.6. The metal is thus an ordinary bronze with a considerable proportion of iron. It will be seen by comparing these alloys, which have the same appearance of a reddish metal, that their composition shows a great diversity as soon as a date below 3000 B. C. is reached. This diversity results in part from the nature of the mineral, but the additions of lead and tin are intentional.

The electric fan, which does yeoman's duty during the hot days of July and August, is found to be no less serviceable in winter. The purpose, to be sure, is totally different. It is found that by placing a fan in a store window, frost is prevented from covering the glass, by reason of the constant circulation of heated air. Patents have been taken out on a split-tube arrangement, which is to be placed at the bottom of the pane of glass, and so connected with a fan as to distribute a current of hot air over the surface of the glass. But the ordinary electric fan is said to answer just as well.



INSECTS IN WINTER.

BY S. FRANK AARON.

THE winter torpidity of insects and of other cold-blooded animals is a subject of considerable interest, about which we know very little. Writers have for the most part taken it up in a general way or have given it little mention. The student becomes at once impressed with the wide difference between torpidity and the hibernation of warm-blooded animals. He finds the latter only a prolonged and more profound sleep, the former a living death which may be quickly thrown off and as quickly resumed with the changes of temperature.

Insects in the preparatory stages—the egg, the larva and the pupa—are entirely immune to cold. They have little or no internal heat to counteract it. The same is true of those in the imago or perfect stage, so long as their sexual functions have not been completed. I have proved by repeated experiments that insects may be subjected to extremely low natural or artificial temperatures, so stiffly frozen that their legs and wings can be snapped off as in the dried specimens; yet after a few minutes' exposure to external heat their vital activity was thoroughly restored.

When, however, my experiments were made with those that had mated and females that had laid their eggs, the attempt to restore them often failed, because such specimens had exhausted their vital forces and would soon have died in any temperature. When a number of ants are artificially frozen and then warmed by external heat, some of them will return to life and activity, while the rest are found to have been killed. The same results follow in experiments on insects of all orders and of all sizes.

When, therefore, insects in the perfect stage seek hidden retreats in which to pass the winter, under loose bark or protecting leaves, or in the crevices of wood, their object is not to find shelter from extreme cold, but from the crushing effects of ice and snow, and especially from the prying search of birds and other enemies. There would be far less chance for these refugees to survive till spring if most of the birds had not migrated southward. But we still have with us during the season of frost and storm the quail and the grouse, scratching for insect food in the loose earth and among the leaves; the woodpecker and the nuthatch, exploring with their sharp bills and sharper eyes the crevices of wood and hiding places under bark; the jay, the chickadee, the purple finch and the winter wren, searching everywhere.

CHRYSALIS OF GRAPTA.

A ray of winter sunshine and a breeze that tempers the frosty air often call forth the long-dormant insects from their snug retreats. When we wander afield on a bright winter day we sometimes see those gay rovers, the Vanessa antiopa butterfly, the Grapta, the Atalanta or the yellow Colias sunning themselves on rocks and logs, or flitting through the leafless woods. Let but a chill wind spring up or a passing cloud obscure the sun, and they vanish as quickly as they came, seeking the nearest friendly shelter. When at last spring fairly returns they are ready for mating, ere long to die when the chief object of their existence has been accomplished.

In houses warmed by wood fires, an occasional stick or log laid near the stove is seen to be swarming with ants which were not visible when the wood box was replenished. These little fellows had been hibernating in crevices of the wood made by the borings of beetle larvæ, and they have now come forth in answer to the genial warmth. House flies, too, are occasionally revived by heat; but generally they perish early in the fall from a white fungus growth peculiar to them, leaving only a few to linger in their familiar haunts during the early winter.

Some of the seemingly feeblest and most perishable forms of insect life surprise the observer by their ability to hibernate and to thaw out quickly under the influence of genial rays. The gnats and midges, those merry dancers in the sunlight, come forth to greet the winter's sun, not only in our milder latitude, but even in the long winters of the far and frozen North.

Centenary of the British Steamship.

Few centenaries are better deserving of commemoration within the United Kingdom than the centenary of steam navigation. And it was just in the close of March, 1802, that the "Charlotte Dundas," the first steamer ever employed for practical purposes, began to tow barges on the Forth and Clyde Canal. Steam vessels had been tried on Dalswinton Loch with success as early as 1788, but they were not intended for use, only for experiment. There were only one or two dreamers, like William Symington, the engineer of the "Charlotte Dundas," and Henry Bell, who built the "Comet" in 1812, who had any idea that steam navigation could ever be turned to practical use.

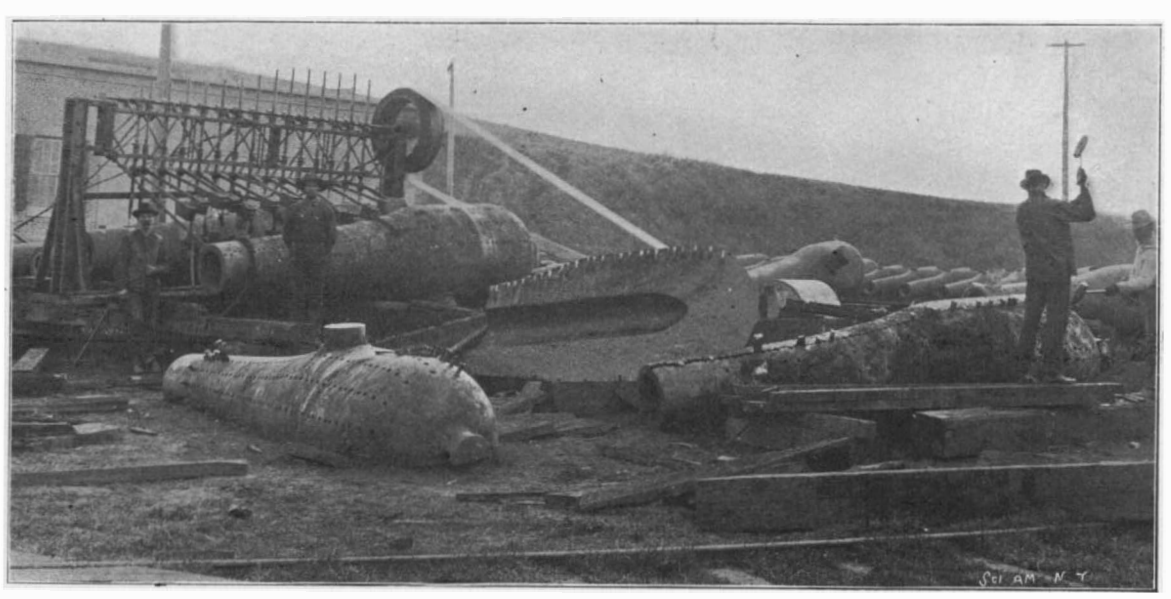
The owners of the Clyde and Forth Canal promptly took steps to stop the running of the "Charlotte Dundas," lest her wash should injure the banks of the canal, and it is even on record that James Watt, the true inventor of the steam engine, threatened William Symington with legal penalties if his engine should prove a success. So the first application of steam to the conveyance of cargo by water ended in financial ruin to the man who had invested his all in it.

WASPS WINTERING UNDER BARK.

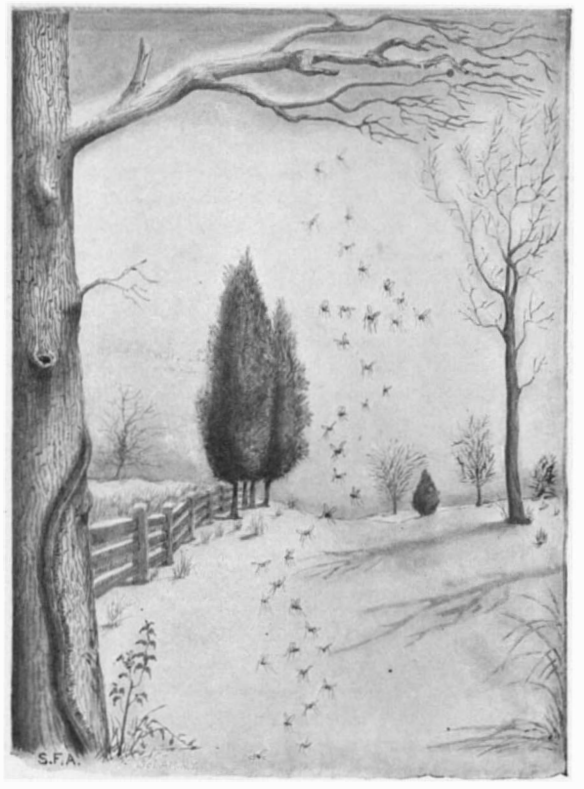
The first passenger steamer was not much more successful from a financial point of view than the first steam tug. Henry Bell applied for aid to the government of the day in order that his idea that warships could be driven by steam might be practically tested. It was in 1800, when a steam battleship in the hands of Nelson might have done much. But no help came from the government. Nor did private capitalists think that there was anything to be made by applying steam to the transport of passenger vessels. So Henry Bell struggled on as best he could, and in 1812 the first passenger steamer appeared on the Clyde. She took her name, the "Comet," from the great comet of 1811. She proved that steam navigation was possible for passenger boats, but she ruined her owner, who died impoverished at Helensburgh, on the Clyde, in 1830.

BREAKING UP 15-INCH CAST-IRON GUNS.

A few months ago a considerable number of old cannon were sold at the Mare Island navy yard, the largest being 15-inch, smooth-bore Dahlgrens. They were made of cast iron for use in the civil war. The problem of reducing these guns to fragments of convenient size to be marketed was a difficult one. At last the contractors devised an ingenious scheme. Rows of holes were drilled longitudinally by a gang-drill, as shown in our engraving. The guns were jacked up on roller bearings, so that they could be easily turned to drill the next row of holes. The holes were one inch in diameter and about 7 inches deep; fifteen were drilled at once. After drilling one set of holes, the drill was shifted endwise about 4 inches, and the second set of holes was drilled. The holes were 4 inches apart, and the rows 8 inches apart. A 30 horse power electric motor was used to operate the drill. After drilling, the guns were split open with steel wedges. Two men were able to open one gun in a day. As each gun weighed 42,000 pounds, the problem of reducing it to smaller pieces had also to be met. A barricade was built over the pieces, and under this the segments were broken into small fragments. Sticks of nitroglycerine powder were inserted in the holes and fired. In this way the guns were broken into quite small pieces.



BREAKING UP 15-INCH CAST-IRON GUNS.



GNATS AND MIDGES IN THE SUNSHINE OF A WINTER'S DAY.

Austria's Canal Scheme.

Of exceptional importance is a measure for a new system of canals which has just been adopted in Austria. According to Mr. Carl B. Hurst, United States Consul General at Vienna, "this undertaking will do more than anything yet enacted in Austria to promote the commerce of the country. It will not only bring the various provinces into closer touch, but will also afford the cheapest freight connections with Germany and Russia."

The measure provides, first, for a canal from the Danube to the Oder; second, for a canal from the Danube to the Moldau, near Budweis; third, for a canal from the Danube-Oder canal to the upper Elbe, and fourth, for a canal from the Danube-Oder canal to the Vistula and to some navigable portion of the Dniester. There will be about one thousand miles of navigable waterways, which will be constructed by the State with the co-operation of the provinces, districts and towns, and especially of Vienna and Prague. The contributions of the municipalities and provincial authorities can be made either by single payment or in annual installments, or through the erection of certain works, such as harbors, docks or streets leading to them, or through the cession of land or water rights.

The work of construction will begin at the latest during 1904, and the entire system will be finished within twenty years. The cost of construction, in so far as it will not be covered by contributions, is to be met by an issue of four per cent tax free government bonds, redeemable within ninety years. The government is empowered to issue these bonds to an amount not exceeding $50,750,000 during the period of construction, from the year 1904 to 1912, and the money thus raised shall be used only in building the designated waterways. For the expense after 1912 due provision will be made by law. The entire cost of construction is estimated at $152,150,000, and the canals will be designed to admit boats up to six hundred tons burden.

Only the girls in a telephone exchange in New York city and the officials of the telephone company know what a vast amount of business is transacted in the American metropolis by telephone. In New York and its suburbs about 120,000 telephones are in use, more than in all France. These 120,000 telephones are used in ringing up the central stations about 426,000 times a day.

Electrical Notes.

M. Edward Branly, the well-known French electrician, who has long been interested in the problem of wireless telegraphy, has now perfected a device which it is stated will considerably develop communication by this means. It is called the improved Branly radio-conductor. The Branly coherer is already employed in wireless telegraphy, but the value of the new device is the important discovery that any two pieces of metal, provided one of them be polished or oxidized, will serve all purposes of the tube. Any metal will suffice for this object. The result has even been secured with a common needle. The new radio-conductor consists of a horizontal plaque of polished steel connected with one pole of the circuit, on which rests a small metallic tripod connected with the other pole, the three points of the tripod being oxidized.

An ingenious electric switch for crossovers of road surface railroads has been devised by Messrs. S. Dixon & Sons, electrical engineers of Leeds, England. The feature of the invention is the simultaneous automatic adjustment of crossovers on the rails and overhead wires of an electric system, the object being achieved by means of a small switch conveniently placed in front of the driver of the car. The switch is connected by ordinary electric wires with the trolley head, and is so arranged that when passing a convenient position in front of the crossovers to be moved, by merely turning the switch the points on both rails and the trolley wire overhead are opened, while a second contact after passing the crossover closes them. The necessary batteries for the circuit are inclosed in a box beside the track. The contrivance, which is extremely simple in mechanism, is also fitted with a hand lever, which in case of any breakdown in the electrical equipment can be used to set the crossovers and overhead switch by one movement. The cost of the equipment is about $500 for each set of crossovers.

A comprehensive idea of the remarkable developments of electrical traction in England, especially in London during the past two or three years, may be gathered from the fact that whereas last year Parliamentary powers were sought for an expenditure of $200,000,000 on tramways in the United Kingdom, this year the capital required for the proposed tubes, trams, and trains in London alone represents an outlay of not less than $250,000,000. The possibilities of electric surface railroads in the English metropolis may be gathered from the fact that the London United Tramways, with 16 miles only in operation, carried in twelve months 35,000,000 passengers; while in the same districts in which this street railroad is in operation, there are now under construction 42 miles, and new extensions are proposed of 15 miles, making a total, with tubes and light railways, of 94½ miles. Hitherto one of the greatest obstacles to electric progress in Great Britain has been the discouragement presented on the one hand to scientific and manufacturing skill, and on the other hand to financial enterprise, by illogical legislation. This prejudice against electric traction, however, has now been overcome, and Parliament is seeking to encourage its development as a solution of the problem of housing the working classes, by affording rapid transit facilities between the city and the suburbs. At the present time the capital invested in Great Britain in electric light, power and traction is $4.30 per head of the population, in Germany it is $2.50, and in France $1.64.

For some time past pressure has been brought upon the English government for the establishment of direct telephonic communication between London and Brussels, similar to that already existing between London and Paris, but it has hitherto proved unavailing, since the distance was considered too great between the English and Belgian coasts for laying a submarine telephone cable. Now, however, all difficulties in this direction have been surmounted, and a cable is being manufactured for spanning the North Sea. The work is being carried out for the British postal department, who are working in conjunction with the Belgian government. It is anticipated that the laying of the cable will occupy about six weeks, if the weather is propitious. The cable, which will be the longest submarine telephone cable in existence, will run from St. Margaret's Bay, near Dover, to La Panne, a point near Ostend, fifty-six miles distant. At Brussels, by means of the exchange, facilities will be made for a person in London to ring up a correspondent in any town in Belgium with the ease with which it is now possible to talk between the English and French capitals. Except on rare occasions, when there is heavy weather in the Channel or through some other cause of defect, persons talking over the wire between London and Paris can hear one another as distinctly as if they were in one room together, and the authorities state that there is no reason why it should not be the same in the case of Antwerp and Brussels. Should this attempt prove successful, preparations will be made for connecting London with other European cities by telephone.

AN ACETYLENE WIRELESS TELEPHONE APPARATUS.

The accompanying illustrations represent a new apparatus for the making of experiments in light-telephony. In all such apparatus selenium is used, which possesses the remarkable property of varying in electrical conductivity with the amount of light to which it is exposed.

Fig. 1 represents the transmitting apparatus, consisting essentially of a gas-flame manometer, *m*, by means of which the rays of an acetylene light, *f*, concentrated by the condensing-lens, *l*, may be varied in intensity. These differences of light intensity, which correspond exactly to those of the sound-waves of the human voice, transmitted through the speaking-tube, *s*, are sufficiently pronounced to influence the conductivity of a selenium cell, included in the circuit of a telephone receiver, which reproduces the sounds of the

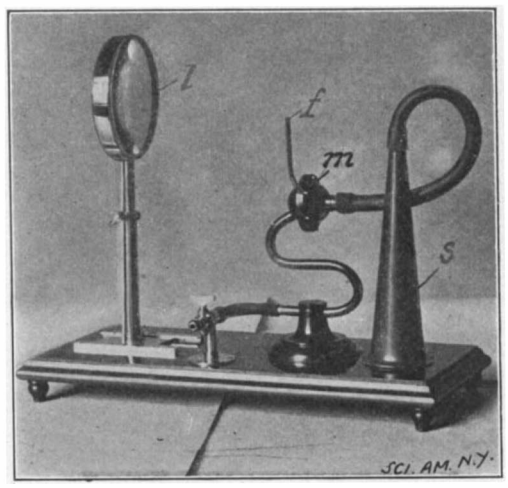


Fig. 1.—THE TRANSMITTER.

voice. In other words, as the light varies with the acoustic waves, the selenium cell is so affected as to cause the current flowing through its circuit to fluctuate, thus giving rise to vibrations of the diaphragm of the telephone receiver, which in turn produce acoustic vibrations.

In order to reproduce the sounds transmitted by the speaking light, the receiving apparatus shown in Fig. 2 is used. The vital part of this apparatus is a concave mirror of German silver; a selenium cell, *S;* a battery, *B;* a polarized relay, *R;* a signal-bell, *G;* and two telephone-receivers, *T*.

In experimenting with these two pieces of apparatus, the transmitter is so placed that the parallel pencils of light emerging from the condensing-lens are caused to fall upon the concave mirror of the receiver. Since the selenium cell, *S*, is mounted in the focus of this mirror, it will be influenced in the manner we have described. The relay will, therefore, be energized and

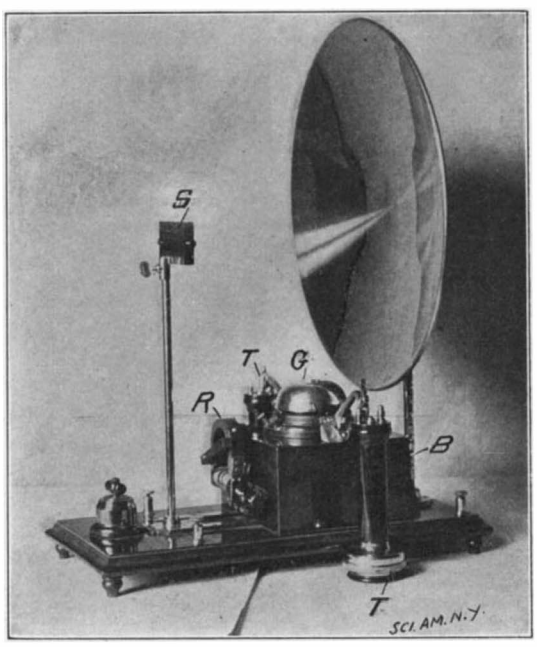


Fig. 2.—THE RECEIVER.

will influence the circuit of the bell, *G*, thereby giving a signal. The bell will ring only during the period in which the rays from the condensing lens fall upon the concave mirror, and will cease its ringing when the telephone receiver is removed from its hook, which occurs because a contact spring cuts out the bell and closes the telephone circuit. Every word that is spoken into the tube, *s*, of the transmitting apparatus can now be distinctly heard in the telephone-receiver. When the receivers are hung up, the transmitter is ready to send another message.

This set of apparatus is particularly well adapted for the demonstration of selenium telephony, whenever it is impossible to employ the Simon speaking-arc light. We are indebted to Messrs. Clausen & Von Bronk, Berlin, for our information.

Pets That Have Become Pests.

The farmers in the vicinity of Wilkesbarre, Pa., have reason to regret their kindheartedness. During the winter—which is said to have been colder even than the proverbial one which the old resident tells about—many sparrows and crows were either frozen or starved to death. Moved by this sad condition, many farmers fed the birds in the morning and evening. This charity, begun by a few, soon spread, until it became the fashion throughout the farming region to feed the birds. During the winter the promiscuous feeding of half-starved birds was a source of delight to children. Now there is a different tale to tell. So accustomed have the birds grown to the daily meals, free from all searching on their part, that they now fill the farmyards seeking food. Open barns are invaded, and wheat disappears in large quantities. The birds perch on the clotheslines on washing day, walk into the houses, and are now so tame that attempts to drive them away are not seriously taken. When spring planting begins more trouble may be expected. It looks as if some slaughter of the birds may be necessary.

Peculiar Currency.

The currency of Abyssinia is somewhat varied, to judge by an account given of it by Count Gleichen in his story of the mission to Menelik, and reprinted by Popular Science Monthly.

For standard money the people of Abyssinia use the Maria Theresa 1780 dollars, but for small change a very different coin is resorted to. This is no other than a bar of hard crystallized salt, about ten inches long and two and a half broad and thick, slightly tapering toward the end. Five of these bars go for a dollar at the capital.

People are very particular about the standard of fineness of the currency. If it does not ring like metal when struck with the finger-nail, or if it is cracked or chipped, they will not take it. It is a token of affection when friends meet to give each other a lick of their respective amolis, and in this way the value of the bar is decreased.

A New Comet.

Dr. William R. Brooks, Director of Smith Observatory and Professor of Astronomy at Hobart College, has discovered a new comet. The position of the comet at the time of discovery was right ascension, 22 h. 55 m. 40 s.; declination north, 29 deg. 12 min. From a telegram received at the Harvard College Observatory, a later observation gives the position, right ascension 23 h. 8 m. 10 s.; declination north, 27 deg. 25 min.; hence it follows that the comet has a daily motion in right ascension of +12 minutes, and in declination — 2 degrees. The direction is southeasterly toward the sun. Amateur astronomers will find this comet in the northwest corner of the great square of Pegasus, traveling diagonally across the constellation. The Harvard description states that the comet is "brightish, with tail." Prof. Brooks now has a record of having discovered twenty-three comets.

The Current Supplement.

The leading article in the current Supplement, No. 1373, is an interesting description of a new Canadian iron and steel plant, which is illustrated by six half-tone engravings and which describes the most improved modern method of making steel. Airships just now are very much in evidence; for that reason an article by Mr. Stuart-Bruce on war-balloons, is timely. The automobile section of the Supplement is represented by an illustrated description of the recent Leipsic automobile show, as well as by a discussion of alcohol as a motive agent. Carroll D. Wright, who is probably the foremost American statistician, describes the working of the Department of Labor. Randolph I. Geare concludes his interesting illustrated serial article, "From Raft to Steamship," with a description of modern steam navigation. The consular notes and selected formulæ will be found in their usual places.

Santos-Dumont and Edison.

One of the first visits of Santos-Dumont was paid to Thomas A. Edison, at his Orange laboratory. According to the daily press, the chief topic discussed was the provision of a light motor for the young Brazilian's airship. Edison is said to have remarked that he never gave his attention to the airship, for the reason that it seemed to him of no commercial practicability as yet, and that he concerned himself only with inventions of commercial promise.

A Record-Breaking Week for the Patent Office.

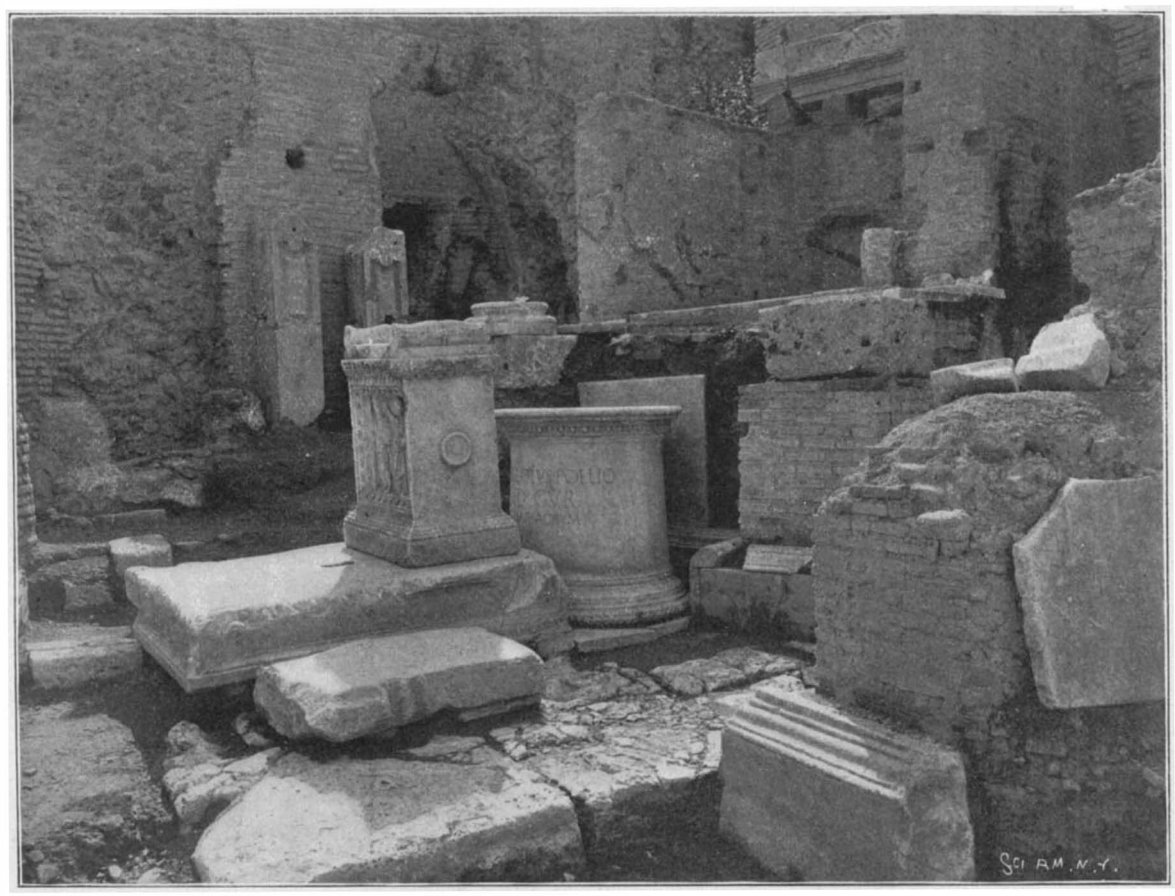
The Official Gazette for April 29 breaks all records for the number of patents illustrated and claimed. The record has been held up to the present time by the issue of the Gazette for April 29, 1890, in which the number of patents shown was 618. By a singular coincidence, both of these remarkable issues bear the same monthly date. The new record is 700 patents.

ROMAN FORUM EXCAVATIONS.

Among the interesting discoveries which have been made in the Roman Forum under the direction of the eminent archæologist Boni, are the Sanctuary and the Fountain of Juturna. As shown in the engraving, the Sanctuary is composed of a small temple or edicule built of brick and oriented north and south. The front was ornamented with two marble columns (one of the bases still remains on the left) which sustained an architrave; upon the latter is engraved the name of the divinity to which the edicule was consecrated. The remains of the architrave, with its inscription, IVTVRNAE . SACRARIUM, may be distinguished in the rear, where it has been placed. In front is a circular well with a well-head of marble, ornamented with an elegant cornice. On the front of the well-head is an inscription showing that the well had been consecrated to Juturna by Marcus Barbatius Pollio. This person, according to Prof. Vaglieri, is the same one who occupied the position of quæstor to Lucius Antonius in 41 B. C. and who has been mentioned by Cicero. In front of the well is a marble altar which has a sculptured relief on the front, with the figures of Mars and a female divinity, Juno or Venus. Prof. Marucchi thinks that the scene represents Juturna saying farewell to her brother Turnus, according to the legend of Virgil.

Another important discovery is that of the Fountain of Juturna. The victory of Tusculum is supposed to have been announced to the Romans by Castor and Pollux, who watered their horses in this spring, which flowed in the Forum near the slopes of the Palatine, and which the ancients called the fountain, or even lake, of Juturna. In making the excavations, M. Boni has brought to light this fountain, so dear to the Romans for its historic souvenirs and also for the salubrity of its waters. As seen in the engraving, a spacious rectangular reservoir built of tufa (*opus reticulatum*) of the time of the Republic incloses the spring. In the middle is a rectangular pedestal, and the whole was faced with plates of marble. The water continues to flow, and is always clear and cool; it is led off by a small opening at the side, through which it flows into a conduit. The fountain was originally roofed over, and here were found several objects of great interest. The first of these is the altar seen in the rear, which has sculptured on its four sides Castor and Pollux, Jupiter with his scepter and thunderbolts, Leda and the swan, and a female figure (seen in the engraving), evidently a goddess, who holds a long torch, very probably Diana Lucina. In fact, the relation between Diana and the fountain of Juturna is well known. The position of the spring also contributed greatly toward the choice of the place where the Vestal virgins guarded the sacred fire. A statue of Esculapius, life size, of white marble, was also found; it was placed here on account of the salutary qualities of the water of the spring. A bust of Jupiter, of white marble and very well preserved, was also found, and a fine horse's head of Pentelic marble, no doubt an original work of an artist of the fifth century B. C. It must have belonged to a group which represented Castor and Pollux with their horses. The head is full size, and fragments of the body of the horse, including the fore-feet, have been found. Another discovery was that of a torso of Apollo in Greek marble of the archaic style, but evidently a Roman imitation of the time of Hadrian. Near the Fountain of Juturna was established a public station, known as the *statio aquarum*, from which the distribution of the water to the city was controlled. Several inscriptions which have been found here speak of this station.

THE FOUNTAIN OF JUTURNA.



RECENT DISCOVERIES IN THE ROMAN FORUM.

New Fields for Trade in the Congo.

About 1,200 miles up the Congo a large river named the Lomami enters the river from the south. It is one of the largest Congo tributaries, says the New York Sun. The population along most of the river is very dense, but the stream is so far inland, almost in the heart of the continent, that until recently no efforts have been made to begin trade with the natives.

About two years ago the Company of the Lomami was formed in Belgium to place steamers on this river, found stations, or factories, as they are called, on its banks, and begin to sell cottons and other goods of Europe in exchange for rubber, ivory and other products. Thus far six factories have been built and a thriving trade is now in progress.

The station or factory of Ilambi is the company's chief post, where its business offices are situated. A dock has been built here where steamers may be repaired, and a carpenter shop and brick yard are in operation. The natives around this post are peaceful and friendly, and trading relations have been established with them.

A little farther up the river is the factory of Yankwamu, surrounded by tribes who are frequently at war with one another, but are at peace with the whites, a considerable number of them having already begun to gather rubber to sell at the station.

The factory at Yahisuli is in full prosperity. The population in this district is exceedingly dense and of a turbulent character, but all the natives are eager to procure European merchandise and gladly labor to procure products which they may exchange for the things they desire.

The building of the factory at Yanga was very difficult because the remarkably dense population was at first hostile. The people in all the large villages deserted their homes upon the arrival of the whites, fleeing to the tribes of the interior; since then, however, they have made friends with the agents of the company, and they as well as natives who live many days' journey from the factory, are now collecting rubber to sell to the whites. Another factory has been established on the Lombo, tributary of the Lomami, two days' march from Yanga. Steamboats can ascend the Lombo as far as the factory. The last station is at Bena-Kamba, the southern limit of the concession.

Throughout this long stretch of the Lomami the vast forests abound with rubber vines. The natives did not know that caoutchouc had any value and have never gathered it before. The newly opened district will add greatly to the rubber resources of the Congo.

The company is opening a number of rubber plantations in which it has set out a great many vines. All of them are thriving, and the prospects are that rubber plantations will become a large feature of the caoutchouc trade on the Lomami.

For three months in the year during the dry season the river is low and navigation in parts of it is impossible. At all other times steamers can easily reach all the stations, and there is besides a good land route connecting these new centers of trade. It is interesting to hear of the beginning of commerce in a region which not long ago was wholly given over to barbarism.

Launching of the "Barry."

On March 22, the torpedo-boat destroyer "Barry" was launched at Philadelphia. The "Barry," which is the last of the three swift torpedo-boat destroyers built by Neafie & Levy for the government, is 245 feet long by 23 feet beam, with powerful triple-expansion engines. Her speed is intended to be 30 knots. The quarters for the crew will accommodate about a hundred men, while light and rapid-firing guns will compose the batteries.

It seems that the much-talked of power canal from the Niagara River at La Salle to Lockport will probably be dug. The necessary charter was secured in 1894 by the Niagara, Lockport and Ontario Power Company. The estimated cost of the hydraulic canal is $6,000,000. Its total length will be 12 miles. At Lockport there is a 240-foot fall, and 100 feet more to Lake Ontario, 12 miles, so that power can be developed all the way to the lake.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLANTER AND CULTIVATOR.—J. R. JONES, Jackson, Miss. The frame of the implement is provided with wheels arranged in tandem. The advance wheel is so shaped as to form in the ground a concavity in the center of which is a groove, for the reception of seed, and the rear wheel is so constructed that it will press the earth or fertilizer to and not upon the planted seed. The forward end of the frame is adjustably supported on wheels so shaped as to direct the earth toward the longitudinal center of the implement frame.

CORN-HARVESTER.—J. L. LOCKE, Beatrice, Neb. This corn harvester is of that class which gathers the ears from standing stalks, and it consists of a corn harvesting attachment which may be applied to any farm wagon without interfering with its carrying capacity. It also includes a husking device, a conveyer for husked ears, and means for directing the husks to a receptacle.

BEET-HARVESTER.—M. W. PALMER, Hamilton, Mich. The machine cuts the tops from the beets, clears a path for the cutter in advance of the operation of cutting, raises the beets to the face of the ground in the rear of the topping cutters, clears them of dirt, and deposits them on the ground where they can be readily picked up.

JOINTER FOR PLOWS.—H. TRAEGER, Auburn, Wash. The invention provides a jointer for plows arranged to form a good joint between adjacent layers of the turned over ground to throw the trash and sod the opposite way from which the plow turns it, so that when the jointer is attached to a right-hand plow, for instance, it throws a narrow strip of sod or trash to the left, while the main portion of the ground is turned over to the right.

Apparatus for Special Purposes.

SOLAR HEATING APPARATUS.—M. DE LA GARZA, Chihuahua, Mexico. The apparatus enables the rays of the sun to be utilized for heating purposes, thereby saving the cost of fuel and obtaining a high degree of heat with cleanliness and without injurious action on the articles which are being cooked. It comprises a swinging frame mounted in a main frame. Lenses on the swinging frame concentrate the heat rays on vessels mounted to swing in a frame relatively horizontal to the swinging frame.

APPARATUS FOR MIXING WORT AND YEAST AND AERATING THEM.—M. WALLERSTEIN and H. H. FREUND, New York, N. Y. The invention has for its object to provide a simple, efficient apparatus which will thoroughly mix yeast and wort and at the same time inject pure, filtered air into them. The device comprises a cylindrical containing vessel and a perforated disk free to slide therein. A manually operated tube provided with an air-inlet extends through the disk and is rigidly secured thereto. A pair of agitating screw blades of opposite pitch are mounted on the tube, and are free to move in opposite directions when the tube is operated.

Dies and Tools.

ROLLER-DIE.—H. HERDEN, Wellsboro, Pa. The invention provides a new and improved roller die for shaping metal plates and bars according to a predetermined design without danger of fracturing the metal plate or causing undue abrasion, drawing, or elongation. The roller die is particularly serviceable in forming triangular and other projections on heavy metal plates.

CUTTER-HEAD.—N. BLY, Crownpoint, N. Y. The cutter is adapted for woodworking and is arranged to permit convenient and quick adjustment of the knives for forming tongues and grooves or for dressing the sides of heavy material and to prevent breaking of the edges of the material in front of the knives, thus insuring a clean cut and considerable saving of lumber.

DIE FOR COVERING TUBES.—P. H. FRIEL, Kenosha, Wis. The invention affords means for covering a tube with a metal casing. Three blocks are employed in the die. The first block has a hole through it which is open along the upper surface of the block. Two adjustable folders are situated at this opening, one projecting outwardly, and the other extending into an opening through the second block. The third block has a plain, round hole adapted to flatten down the curled edges of the jacket.

Electrical Apparatus.

ELECTRIC ARC LAMP.—R. FROMENT, Paris, France. The carbons are normally held together by a spring. A solenoid is employed to hold them apart when the current is turned on. The tension of the spring and the attraction of the solenoid are so arranged as to keep the carbons at a constant distance apart, thus insuring an absolutely fixed light.

Engineering Improvements.

ENGINE.—W. D. LINSCOTT, Piedmont, So. Dak. This engine, which is particularly adapted for use in connection with steam, comprises a number of rotary pistons attached to a common shaft and fitted within a cylinder-like casing. The casing and piston are provided with certain peculiarly formed ribs on which the steam acts, whereby motive force is produced.

TRACTION-ENGINE DRIVING-WHEEL.—K. R. LEEHART, Lucas, Iowa. By an improved construction the calks on the driving-wheel may be instantly projected or withdrawn from the rim, so as to meet the requirements of increased tractive effect on muddy and icy roads, or be as quickly withdrawn before passing over a bridge, so as to do no damage to the flooring, thus saving much time and expense.

BOILER-TUBE CLEANER.—C. T. DEMAREST, Hackensack, N. J. This improved boiler-tube cleaner is adapted to thoroughly cut the soot or scale clean from the interior surface of the flue without much physical exertion on the part of the operator. The flue cleaner comprises a horizontal head provided with a number of spaced cutters projecting from the front and rear ends thereof. These cutters are braced by V-shaped webs connecting them with the main body at the head.

HYDRAULIC MOTOR.—J. G. GELLY, Paris, France. The reciprocating hydraulic motor operates automatically without the intermediary of any distributing mechanism, thus rendering the construction of the apparatus extremely simple. The motor is adapted for erection in either a vertical, horizontal or inclined position.

ROTARY ENGINE.—I. V. KETCHAM, Brooklyn, N. Y. The engine may be driven by a fluid pressure of any sort, but is best adapted for operation with steam. Two cylinders and valve chests are employed. The two circular pistons are fastened to a shaft in common to both. The peripheries of the pistons are formed with steam pockets oppositely disposed in the respective pistons. In operation one piston and its valve stay inactive, while the other piston and valve are in operation, and when the movement of the engine is to be reversed the active piston is arrested and the formerly inactive piston put in operation.

Hardware.

CURTAIN-FIXTURE.—C. E. BAUR, Cripplecreek, Colo. This fixture is adapted to receive vertical and lateral adjustment of its members, so as to compensate for differences in the length of a curtain or of its supporting rod. A slotted bracket plate is employed at each side of the window, the plate having serrations along its front surface at the slot. A washer is seated on the serrations and encircles a headed bolt slidable in the slot. A sleeve on the bolt is seated against the washer, and is held thereto by a nut on the end of the bolt. The sleeve is provided with a laterally extended socket piece which receives the curtain rod. Lateral adjustment is made by a nut which encircles the rod and is screwed to the socket piece.

NUT LOCK.—A. T. WILSON, Chicago, Ill. The nut has a bore near one side intersecting the threaded aperture, which contains a compression spring at the bottom, and a dog bearing thereon. On the side next to the threaded aperture, the dog is provided with teeth which normally engage and lock the thread of the bolt. To unlock the nut the dog is depressed, thus presenting a flattened portion in place of the teeth. A detent shaft holds the dog in an unlocked position.

Machines and Mechanical Devices.

WOOD-TURNING MACHINE.—W. T. JONES, New Westminster, Can. The machine is practically automatic in its operation and is adapted to act upon a plurality of spool-blocks, arranged in axial line, so that they will be simultaneously and finally ejected as finished spools.

DRIVING-GEAR.—J. C. WOODY, Mount Vernon, Ind., W. R. DANLEY, Denver, Colo., W. H. YOUNG, Rockyford, Colo. The invention relates to treadle power for actuating small machines, such as sewing machines, coffee mills, and the like, and provides a new and improved driving gear which is very effective in operation and arranged to directly actuate the machine to be driven and to support the same on the main frame.

DELIVERY-TABLE FOR PRINTING-PRESSES.—E. M. HOWELL, Denver, Colo. This delivery table, used in cylinder printing presses, is arranged to permit of conveniently and quickly adjusting the jogger-boards for properly piling the printed sheets of any desired size.

BEATING-ENGINE.—E. A. JONES, Pittsfield, Mass. Certain new and useful improvements are made in the beating-engines of paper-making machinery which insure a proper circulation of the pulp or stock when the vat is being emptied, and assist the pulp or stock to the discharge pipe without the use of manually actuated rakes now generally employed for pushing the stock to the discharge pipe.

TURNING DEVICE.—G. H. HILDRETH, Seattle, Wash. Mr. Hildreth has invented a novel device for turning and shouldering masts, spars, posts and analogous articles. The wood is turned in a tank filled with water. The floating of the log upon water renders its weight practically nil and also lubricates the bearings or centering devices at the points where friction is likely to occur.

SHUTTLE-GUARD FOR LOOMS.—J. P. LANGE, Passaic, N. J. The invention provides a new and improved shuttle guard, actuated from the lay to move into an active or inactive position, and arranged to effectively prevent a shuttle diverted from its straight cross across the ways from flying upward out of the shed. It thereby insures the personal safety of an attendant, the arrangement being such that the weaver at any time can swing the guard out of the way to gain access to the warp threads and the reed.

TYPEWRITER.—W. J. THOMPSON and P. BECKER, New York, N. Y. The typewriter embodies a flexible type form mounted for rotary movement to locate the type for impression and arranged with certain devices for flexing the type to effect impressions, spacing the characters impressed, and effecting other results necessary to and advantageous in the operation of the machine.

Medical Apparatus.

SKIASCOPE.—K. A. MOTT, Avalon, Mo. The instrument is used for examining and testing the visual power of a person and is arranged to permit of quickly bringing a single lens or any desired combination of lenses into proper position for viewing one eye of a patient, at the same time relieving the other of undue strain.

COMBINED FACE-STEAMER AND INHALER.—H. C. KARPENSTEIN, Brooklyn, N. Y. The invention affords an apparatus for providing a spray of heated vapor, and is designed to enable the patient or physician to readily vary the nature of the vapors and to direct them as desired. It comprises a standard which supports a spray at one side and a vaporizer at the other. The spray head is adjustable, being mounted on a tube which telescopes with the vapor supply tube. At the top of the sliding tube a medicating pan or cup may be placed whereby the steam or vapor may be laden with perfume or medicine.

Plumbing Improvements.

PIPE OR MAIN.—W. S. CORBIN, Johnstown, N. Y. The invention is an improvement in pipes and mains having for an object to provide a novel construction whereby to form a cover for the joint between pipe sections to prevent leakage. Each pipe section has a bell at one end fitting over the end of the next section to which is secured a ductile sealing jacket, also bell-shaped, which fits over the bell-shaped mouth-section. Clamping bands secure the parts together.

AIR-CHAMBER FOR PUMPS.—J. E. SPONSELLER and G. FENNO, Hoisington, Kans. This invention provides an improved air-chamber for pumps and pipe-lines, which can be conveniently arranged at any point of the pump-pipe above the cylinder, can be made of any desired length and diameter, will assure an even flow of water, and will obviate the recoil of the water in the pumping-pipe at each stroke. A cylindrical casing is coupled to the pipe line. The upper coupling is threaded to receive the upper pipe line and the upper end of a central pipe section, the tapered lower end of which fits tightly into the lower coupling. The central pipe is perforated near its lower end for the passage of water entering into the casing.

Railway Contrivances.

ANGLE-COCK ADJUSTER FOR AIR BRAKES.—W. S. DE CAMP, of Chillicothe, Ohio. In the ordinary brake system a train pipe runs from end to end of the car and terminates at each end in an angle-cock to which a flexible hose, that connects the train pipe between the cars, is secured. The angle-cocks are ordinarily coupled up by hand. Mr. De Camp provides a means whereby the engineer may, from his locomotive, adjust any or all the angle-cocks to the open or cut-in position. The pneumatic angle-cock adjuster is designed to be operated by an increase of air pressure in the train pipe over and above a normal pressure of 65 pounds.

Vehicles and Their Accessories.

BICYCLE.—N. E. BROWN, Aitkin, Minn. The bicycle is arranged to allow of riding the machine in the usual manner and can be quickly changed to give the rider a forward and backward canter of the body with an impelling and resisting impulse, producing a very novel and exhilarating motion.

FIFTH-WHEEL.—S. E. BANGS, Booneville, Ark. The object of the invention is to provide a fifth wheel so constructed that the body of the vehicle will maintain a horizontal or level position and prevent jar while the front axle is on an angle caused by one of the wheels passing over a large obstruction. This is accomplished by providing a ball and socket connection between the bolster and the front axle.

CHANGEABLE GEAR FOR BICYCLES.—H. F. MAYNES, Corning, N. Y. The invention aims to provide, in a changeless driving mechanism for bicycles a means for changing the gear and consequently the speed, and further to provide means for bringing the changeable gear into action as a brake. The hub of the rear wheel is provided with independently-acting gears, one gear being for high speed, and the other for low speed. The drive-shaft which is adapted to drive the hub of the rear wheel carries two gears also, one meshing with the high speed gear and the other with the low-speed gear of the hub. Means are provided for bringing either the high-speed or the low-speed gear in action through back-pedalling. A brake-operating arm is likewise carried by the hub of the rear wheel and is also brought into action by back-pedaling.

DRAFT-EQUALIZER.—H. HENDRICKS, Kinbrae, Minn. The device is adapted to even up the draft exerted by a team of five horses, one of which may walk in the furrow while four horses may walk in the stubble if the equalizer is employed on the plow. Connected to one end of a primary lever is a doubletree and at the other end is fulcrumed a secondary lever to which is secured at its inner end a singletree and at its outer end a doubletree. The levers are so arranged, as to position of fulcrum and length of arms, as to equalize the draft.

END-GATE-ROD FASTENER.—W. A. DAY, Clay Center, Neb. This improved end-gate-rod fastener is simple and durable in construction and arranged to securely hold and lock an end-gate-rod in place, and also permits quick unlocking and removal whenever it is desired.

FOLDING CARRIAGE.—C. E. FANNING, Davenport, Iowa. Mr. Fanning has invented a new and improved folding baby-carriage which can be quickly extended for use or readily folded into a comparatively small space for conveniently carrying it about, especially up and down narrow stairs or in hallways, street cars, etc.

Miscellaneous Inventions.

SHOW-CASE.—A. REINLE, Baltimore, Md. In the construction of all-glass show-cases, it becomes desirable to connect the glass in such a way as to avoid any interference with the neat appearance of the case. Mr. Reinle prefers uniting the plates together with cement. A metallic layer overlies the uniting cement and adheres to the inner surface of the glass, so that the case will present the appearance of having a silver or gilt layer at the point of contact of the glass plates.

MAIL-BAG CRANE.—C. J. NORDVALL, Evanston, Ill. This mail-bag crane is light yet strong and durable, and in its construction old railway rails may be utilized. The bag is held by spring clips between two bars pivoted to the standard. The catcher on the mail car by engaging the mail bag will release it from the supporting bars, permitting the lower bar to fall and strike against a plate, thus moving a tripping device rearward and allowing the upper bar to drop out of the way of other passing trains.

MEANS FOR PRESSING, PERFORATING AND CUTTING GLASS IN SHAPES.—A. J. NASH, New York, N. Y. The invention provides means whereby at one operation a sheet of glass may be pressed and parts cleanly removed, so that various openings of any design may be produced in the sheet and the openings may be filled with material of different character and color, and so also that the particles removed may be utilized for tiling or for analogous purposes.

LAMP-LIGHTER AND MATCH EXTINGUISHER.—W. R. CAIN and OLIVE B. KANE, Port Jervis, N. Y. The match is inserted in a tube in the lamp or lantern, and as its outer end is depressed, the head of the match is brought into contact with a short arm which yields sufficiently to permit the head to travel along its under surface in contact with the serrations thereon, by which friction sufficient to ignite the match is produced.

VAPOR-GENERATOR.—M. CASTELNAU and C. THIALON, Paris, France. Most of the generators of instantaneous vaporization made up to the present time comprise capillary passages, so that they become rapidly obstructed and are very difficult to clean. These inventors have discovered that calefaction and instantaneous vaporization can be produced without the help of capillarity, and they have constructed a vaporizing element having a large inner duct and no capillary passages whatever. By a novel process the requisite element is formed, which consists of a block of hard steel in the interior of which is provided a duct bent back on itself three times over and of which the ends open out on one and the same surfaces.

FIRE-ESCAPE.—W. R. and N. B. CAIN, Port Jervis, N. Y. A chain or rope is employed for lowering persons to the ground and passes through a drum or casing secured to the wall of the building. The rope operates an automatic brake mechanism whereby the descent of the persons is regulated.

CIGAR-MOISTENER AND PRICE AND BRAND TICKET.—S. STRAUSS, New York, N. Y. The moistener is adapted for attachment to cigar boxes, and when in position will be held over the cigars, yet out of contact with them. A clamp-support is provided, upon which the moistener is pivoted, enabling a person to quickly move it out of the way. The upper face of the moistener may be utilized as a label or ticket indicating the name, character, and price of the cigars in the box.

COLLAPSIBLE BOX.—H. H. KINSEY, Shoshone, Idaho. The box comprises a bottom, end pieces having hinged connection therewith, side pieces, a top or cover having loops at the side edges to engage against the outer sides of the side pieces, and fastening devices for engaging the top or cover in place, these fastening devices being below the top plane of the cover.

ASSAYING-FURNACE.—A. C. CALKINS, Los Angeles, Cal. The furnace is adapted for use

with gas or of volatizable hydrocarbon as a heating medium. It is more particularly a combined muffle and melting furnace, comprising a central combustion chamber having a fire opening, a muffle which traverses the chamber above this opening, crucible chambers located on each side of the main chamber, and lateral passages connecting the three chambers, the latter being provided with removable covers.

STOCKING-GUARD.—H. WEIL, New York, N. Y. The stocking-guard is designed particularly for protecting children's stockings from wear at the knees, and it provides an inexpensive construction that will readily yield to the movement of the child's legs and which also, when not in use, may be folded in compact form.

TOOTHPICK-HOLDER.—C. A. YARRINI, Havana, Cuba. The holder is so constructed that a bundle of picks contained therein may be ejected one at a time as required for use, thus preventing the handling and possible soiling of the toothpicks remaining in the bundle.

NECKTIE-FASTENER.—G. GREITE, Guttenberg, N. J. The necktie-fastener comprises a plate of sheet metal provided with ears and with fasteners secured to a necktie shield. A Y-shaped clasp is pivotally secured to the plate and provided with a rocker-like member terminating in pointed feet. A torsional spring engages the plate and the clasp. The clasp normally holds the Y-shaped member in such a position that the pointed feet engage the plate.

NUT-CRACKER.—W. V. DICKEY, San Antonio, Texas. The device is particularly well adapted for fracturing the shells of pecan nuts, so as to release the meats or kernels therefrom without injuring them. The hammer-blocks are provided with mating cavities in adjacent ends, wherein the nuts are separately placed when operated upon for fracturing their shells.

DRAFTSMAN'S INSTRUMENT. — E. C. LOETSCHER, Pittsburg, Pa. The instrument has for its object to provide a simple and convenient tool for drawing lines at various angles, for dividing lines into various numbers of parts, and for readily solving other problems occurring in the draftsman's practice. It comprises a rectangular celluloid plate upon which various scales and angles are marked.

MILK-MODIFYING GAGE.—J. A. MITCHELL, New York, N. Y. The gage comprises a strip of sheet-material bent twice at right angles, the bent portions being spaced apart a distance commensurate with the size of a milk bottle, for the purpose of embracing the exterior of the bottle. The gage is provided with graduated scales which indicate the quantity of milk, lime-water, and boiled water that are to be mixed together in the food of infants.

COOKING STOVE OR RANGE.—ELEANOR CLARKE, Mariasville, Pa. The stove embodies an extensive capacity for utensils in cooking, a graded radiation of heat throughout the plate surfaces, and a body occupying comparatively small floor space adapted for ventilation and to conduct away resulting steam and gases in cooking.

MINIATURE THEATER.—A. L. MCCORMICK, Port Huron, Mich. The miniature theater provides an automatically operated apparatus in the nature of a model playhouse, having scenery and other accessories by which to represent in succession a number of scenes or acts of a play. The stage is provided with slots through which actors or other figures are caused to pass into or out of view, the figures being supported upon suitable keys or levers operated automatically.

BEDSTEAD.—S. E. CLAUSSEN, Walla Walla, Wash. Mr. Claussen has invented an improvement in bedsteads relating particularly to the connection of the post with the rail of the bed. Means are provided for holding the rail and post together, permitting the regulation of these parts if they are not straight, and serving to brace the bed in that region.

PROCESS OF MAKING REPAIRED FABRICS.—D. MARGOLIUS, Norfolk, Va. This invention seeks to provide a method of effectually repairing mutilated rough bagging which has been used in covering cotton bales, so that it may be resold to the planters in practically as good a condition as when originally used. This is done by continuing the cut in the material along to its edges, thus dividing it into two disconnected parts. These two parts are then joined by knotting together the severed threads.

Designs.

DESIGN FOR PICTURE-FRAME. — E. GOETTE, Newark, N. J. The leading feature of the design consists of a semi-wreath of leaves arranged with scroll effect upon a border, and a ribbon-tie appearing to secure the semi-wreath to the border.

DESIGN FOR RING TRAY.—J. L. HERZOG, New York, N. Y. The leading feature of the design consists in the body having a general diamond shape, the opposite sides of which are formed in segmental curves, giving an escalloped effect, while the opposite sides of the end-portions are formed in compound curves. Slots for the rings are arranged in various lines with relation to the center.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Motor Vehicles. Duryea Power Co., Reading, Pa.

Inquiry No. 2432.—For manufacturers of spring motors.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 2433.—For dealers in novelties.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 2434.—For addresses of philatelical papers published in United States, Canada and South America.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 2435.—For makers of solid rubber bicycle tires.

Castings to order for oil, gas and gasoline stoves. Atlantic Foundry, Phillipsburg, N. J.

Inquiry No. 2436.—For manufacturers of invalid chairs, etc.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 2437.—For manufacturers of celluloid and xylonite suitable for knife handles, etc.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 2438.—For dealers in rolled gold wire.

Steel name stamps, stencils, steel letters and figures and brass checks. C. L. Alderson, Cleveland, O.

Inquiry No. 2439.—For manufacturers of steam riding galleries.

Are you looking for anything in bent woodwork? Write Tucker Bicycle Woodwork Co., Urbana, Ohio.

Inquiry No. 2440.—For machinery for making brackets and pins for telephone lines.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 2441.—For the firms who make the felt covering for the United States government canteens.

FOR SALE.—To party direct, for cash, patent 608,925 on folding umbrellas. No selling agencies need answer. M. R. Studams, Bridgeton, N. J.

Inquiry No. 2442.—For manufacturers of plates of aluminium.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2443.—For machinery for making horn combs.

Factory room to let, with power, steam, elevators, etc. Good light, also storage room. Charles F. Kilburn, 84-86-88 Mechanic St., Newark, N. J.

Inquiry No. 2444.—For dealers in granulated copper or machinery for making the same.

WANTED.—Motor vehicle for passenger traffic on country roads. Large contract if sample all right. Electric Power barred. Address E. and D., Box 773, N. Y.

Inquiry No. 2445.—For a cheap ice-making machine for household use.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2446.—For manufacturers of acetylene gas generators.

IDEAS DEVELOPED.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 2447.—For manufacturers of ear tubes, etc.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 2448.—For makers of solid, rust-proof harness metals, dashboards, etc.

WANTED.—A thoroughly reliable man to manage Steam Specialties Department in large wholesale house. Must be sober, competent and experienced. Give age, experience, references and salary expected. Address Box 482, New Orleans, La.

Inquiry No. 2449.—For makers of hollow copper or brass wire.

Patents developed and manufactured, dies, special tools, metal stamping and screw machine work. Metal Novelty Works Co., 43-47 S. Canal St., Chicago.

Inquiry No. 2450.—For machinery for copying the flat surface of a clarinet mouthpiece.

Our specialty is cutting and forming metal parts any shape. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 2451.—For makers of paper rims or tires for placing over iron wheels.

FOR SALE.—Castings for 2 x 4 Corliss type engine with blue prints. Send for circular. E. A. Sikes, Lock Box 4, Cherry Valley, Mass.

Inquiry No. 2452.—For makers of electric motors.

Inquiry No. 2453 —For parties to make typewriter parts by contract.

Inquiry No. 2454.—For manufacturers of portable lamps burning kerosene.

Inquiry No. 2455.—For makers of broom machinery.

Inquiry No. 2456.—For manufacturers of marine pipe boilers for launches.

Inquiry No. 2457.—For dealers in telegraph and telephone supplies, also static machines.

Inquiry No. 2458.—For manufacturers of small cast iron specialties, such as toy engines, etc.

Inquiry No. 2459.—For the address of a shipbuilding or ship windlass company in Canada.

Inquiry No. 2460.—For a partner to help build and patent an improved flying machine.

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Inquiry No. 2462.—For manufacturers of automobiles.

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Inquiry No. 2464.—For wholesale dealers in old iron, metal and rubber.

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Inquiry No. 2467.—For dealers in materials for covering shingles to prevent leaking.

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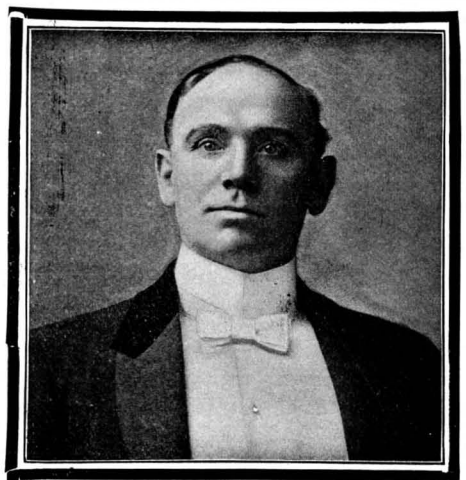
Locking device, C. B. Foote, Jr..... 697,938
Locomotive, J. Player 697,535, 697,536
Locomotive driving wheel, L. H. Kenyon... 697,850
Locomotive engine ventilator, N. Kershner.. 697,493
Loom, J. E. Painter..... 697,745
Loom picker check, C. A. St. Onge..... 697,562
Loom shuttle, F. H. Martin..... 697,508
Loom shuttle, O. Gleason..... 697,713
Loom, weft replenishing, H. W. Smith..... 697,684
Mail box, A. F. Corbin..... 697,450
Match box, S. Biren..... 697,601
Match box filling machine, L. Mettewie et al 697,514
Measuring and drawing liquids, apparatus for, E. Franc..... 697,830
Metal from receptacles, drawing molten, L. Lincoln..... 697,638
Metal sheet piling, G. W. Jackson..... 697,943
Metal wheel, W. H. Schofield..... 697,950
Metal working machine, W. M. Roberts.... 697,887
Metals by electrolysis, recovering, H. A. Frasch..... 697,831
Mica board making machine, H. F. Watson. 697,696

(Continued on page 300)



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Molding machine, sand, D. L. Adams	697,593
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Nut lock, M. McDonald	697,870
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Oiler, A. M. Alden	697,700
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Ore roasting furnace, T. D. Merton	697,863
Ornamenting, method of, Blair & Horn	697,602
Package, C. A. Lindsay	697,503
Package, shipping, J. T. Ferres	697,463
Packing gasket, J. J. & A. Schier	697,546
Paddle wheel, H. Glardon	697,712
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Rail joint, P. Baran	697,775
Rail joint, S. W. Leslie	697,858
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Railway, A. Webb	697,904
Railway coaches or sleepers, dust and cinder guard for, J. S. McKeuzie	697,526
Railway crossing, B. M. Rawlings	697,540
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Sash tightening device, C. B. Foote, Jr	697,939
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Saw guide and tension device, band, A. Gillarduzzi	697,711
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Saw tooth gage, R. E. Poindexter	697,883
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Screw driver, J. G. Gorham	697,836
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Sifter, flour, W. M. Viser	697,903
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Singletree hook, T. S. Young	697,929
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Steam boiler, J. S. Stevens	697,561
Steam generator, combined water and fire tube, T. R. Butman	697,606
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Stove, heating, T. M. Anderson	697,428
Stove, heating and cooking, J. C. Parmerlee	697,876
Stove, heating, cooking, and baking, R. C. MacCulloch	697,506
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Suspenders, I. Wechsler	697,905
Suspenders, J. P. Heiser	697,916
Tablet, Altermatt & Van Tine	697,773
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Telegraph sounder, G. A. Green	697,619
Telephone, A. Neri	697,528
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Thill coupling, C. C. Bradley	697,603
Thill coupling, W. F. Schaeffer	697,667
Threshing machine, F. P. Sutton	697,563
Tire, cushion, W. H. St. John	697,691
Tire inflater, H. K. Austin	697,597
Tire, pneumatic, C. E. Thomas	**697,564**
Tire, pneumatic vehicle, E. Greene	697,621
Tire, rubber vehicle, F. H. Hyde	697,626
Tires of rubber, etc., apparatus for equipping vehicle wheels with, W. S. Brooks	697,441
Tobacco drying machine, leaf, D. C. Mayo	697,512
Tobacco stem treating machine, D. C. Mayo	697,511
Tongue for vehicles, metal, W. H. Schofield	697,951
Torpedo launching apparatus, J. Whitehead	697,906
Toy, J. Flindall	697,958
Toy boat, D. L. Ferguson	697,709
Toy, coin controlled, W. C. Haigh	697,478
Tracing pictures, etc., means for, E. L. Williams	697,764
Track, portable bicycle, Mitchell & Link	697,643
Train signal, A. Novak	697,654
Tramway or similar points from vehicles, means for operating, W. A. Day	697,609
Trolley catcher, automatic, T. B. Shanahan	697,674
Trolley harp, Turner & Mitchell	697,572
Trolley pole, F. L. Fowler	697,828
Trolley pole, Pullman & Field	697,884
Trolley wheel, W. Sellers	697,892
Trolley wire hanger, I. L. Edwards	697,937
Trolley wire recessing mechanism, W. A. McCallum	697,648
Truck bolster, R. V. Sage	697,664
Truck, car, S. A. Crone	697,452
Tube bends, machinery for manufacturing, J. Bradley	697,604
Tubular boiler, J. A. Steinmetz	697,560
Turning machine, wood, W. J. Cochran	697,607
Type casting machine, F. Lucke	697,859
Type writing machine, G. J. Barrett	697,430
Type writing machine, L. S. Burridge	697,605
Type writing machine, C. H. Shepard	697,676
Type writing machine, F. Sholes	697,678
Type writing machine copyholder and line indicator, F. C. Shobert	697,895
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Vaccinations, etc., shield for, J. E. Lee	697,637
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Valve for steam carriages, throttle, R. H. White	697,586
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Vehicle running gear, C. F. Burns	697,800
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Vehicle spring gear, D. True	697,570
Vehicle steering lock, G. P. Aborn	697,699
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Velocipede pedal, J. H. Barry	697,780
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Piano player case, H. E. Sharps	35,871
Sewing machine cabinet, W. Person	35,870
Spoons, forks, etc., handle for, W. C. Codman	35,859
Spoons, forks, etc., handle for, E. Meyers	35,860, 35,861
Spoons, etc., handle for, E. H. H. Smith	35,862
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Stove or range, cooking, J. J. Graves	35,867
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Talking machine horn supporting arm, L. P. Valiquet	35,873
Toy bank, J. W. Eshleman	35,864
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Depilatory, H. W. Paske	38,124
Dolls, Hamburger & Co	38,095
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Dry goods, certain named, J. H. Poor	38,102
Explosives, Safety Explosive Co	38,136
Explosives, fuses, and electric batteries, certain named, Laflin & Rand Powder Co.	38,137
Fabrics, certain named, G. Willis	38,100
Fabrics, woven cotton, A. M. A. Richardson	38,099
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Mineral water, AbilenA Co	38,117
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Sheetings and drills, H. Norden	38,103
Shirtings, sheetings, and drills, E. L. Suffern	38,106
Shoes and hose, Chambersburg Shoe Mfg. Co.	38,110
Silks, dress, Liberty Silk Co	38,098
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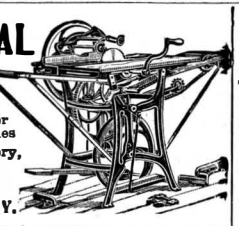
Spoons, J. B. & S. M. Knowles Co	38,096
Varnishes, F. Happell	38,130

(Continued on page 301)

WOOD or METAL Workers



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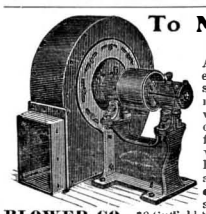

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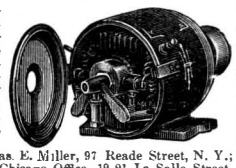

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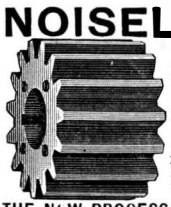

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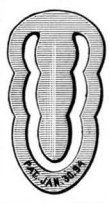

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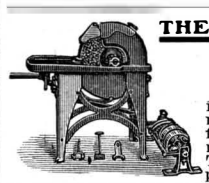

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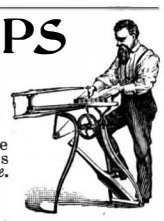

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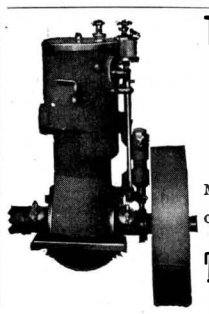

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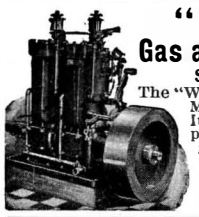
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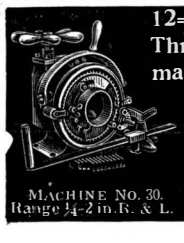
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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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HINTS ON PLAYING THE JANE NAVAL WAR GAME. (Naval Kriegspiel.) Together With All the New Rules and Official Changes. By Fred. T. Jane, inventor of the game. London: Sampson Low, Marston & Co. 1902. Pp. 47.

The Naval War Game, or Kriegspiel, was designed to enable the players to realize as close a simulation of real warfare as is possible. The idea of the game is that any naval officer should be able, without any knowledge of the game, to direct the evolutions of the fleet. It is described by the author as the antithesis of chess, billiards, etc., in that mere proficiency of moving, and so on, does not entail victory, which depends upon the skillful handling of the fleets. The game is played with miniature models of the various warships of the world on boards marked out in squares. There is a code of rules drawn up, and a system of awarding points. That the game gives a very close approximation to actual naval warfare conditions is proved by the fact that it is enormously popular among the navies of the world, practically all of which have officially adopted it. The hints on playing the game are designed to familiarize the players more completely with the true intention and scope of the game. We notice, by the way, that in the sum total of points given to the various warships of the world, the "New Jersey" comes as first with 116 points, the "King Edward" of the British navy and the "Brin" of the Italian navy next with 104 points. There is a mass of information in this work which would be of interest to those who follow the growth of our navies, but who have no intention of playing the game itself.

EXPERIMENTAL SOCIOLOGY. Descriptive and Analytical. By Frances A. Kellor. New York: The Macmillan Company. London: Macmillan & Co., Ltd. 1901. 16mo. Pp. 316.

The author, who, as the title page informs us, is a graduate student of the University of Chicago, has produced a book which is devoted primarily to the study of methods of the investigation of delinquents and their treatment. The author recognizes that what has been done is not a complete study. But taking the book for what it is worth, it certainly should secure interest. The information which has been collected is presented in such an attractive form that the reading of the book is more agreeable than might be expected from its title.

ALL THE WORLD'S FIGHTING SHIPS. A Practical Naval Annual for Practical Men. By Fred T. Jane, inventor of the Jane Naval War Game. New York: Harper & Bros. 1901. Pp. 397. Illustrations.

This work is by far the most complete naval annual in the world. It is also the most practical and technical. It contains a photograph of every warship in the world, also a deck plan and sheer plan on which the position and thickness of all the armor, and the position and caliber of every gun are indicated. There are also two silhouettes of every warship and also of every merchant ship that might be of service in war. On the same page with the photograph and the plan of each ship is a table giving the leading dimensions of the vessel, the size and character of its guns, thickness and nature of its armor, together with its speed, fuel supply, etc. There are also articles on the year's progress in gunnery, marine engineering, armor, torpedoes, construction, strategy, tactics, signaling, etc. For the use of officers at sea it is a particularly valuable work, inasmuch as there is crowded into its pages matter that would ordinarily require several volumes for its presentation.

(*Continued on page 302*)

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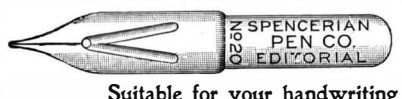

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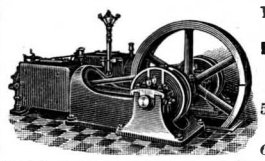
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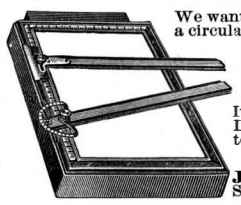
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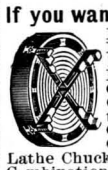

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THE BLOCK SYSTEM OF SIGNALING ON AMERICAN RAILROADS. By Bram B. Adams. New York: The Railroad Gazette. 1901. 8vo. Pp. 260.

In view of the present discussion of signal systems, which has been aroused by the recent accident in the Grand Central tunnel, New York, the above work, which is from the pen of a practical railroad man and one of the editors of a leading railroad journal, is particularly timely. The subject is treated in a most thorough and practical manner, and is fully illustrated with half-tone engravings and line cuts, the latter being freely lettered and very completely described in the accompanying text. The drawings are very clear, both the smaller illustrations showing mechanical details and the general plans of yards and signaling installations being worked out with a comprehensive thoroughness that leaves nothing to be desired. The work is clearly written, and covers the ground with great completeness. The telegraph block systems of three of the largest railroads of the country, including the Pennsylvania, are described in three separate chapters. Then follow a chapter on single-track blocking, and two chapters on the controlled manual system as used on the N. Y., N. H. & H. Railroad. The last five chapters are devoted to descriptions of the various systems of interlocking. While the work is primarily one for the engineer and the superintendent, it should be in the hands of every railroad man whose duties necessitate his familiarity with signals and their operation.

THE PREVENTION OF SMOKE. Combined with the Economical Combustion of Fuel. By W. C. Popplewell, M.Sc. New York: D. Van Nostrand Company. London: Scott, Greenwood & Co. 1901. 8vo. Pp. 203. Price $3.50 net.

The main portion of this book is devoted to a brief statement of the principles underlying the smokeless and economical combustion of fuel: a description of the most recent practice for burning fuel for commercial purposes; a review of a number of complete trials recently made with the object of showing the best methods of dealing with coal for the purpose of steam raising, and, lastly, a summary of the law as it relates to the smoke question. This scheme, both simple and logical, has been carried out thoroughly. The illustrations in the book might well be improved; but the printing is excellent.

THE SOAP BRAND RECORD AND TRADEMARK MANUAL. By Leebert Lloyd Lamborn, B. S. New York: Charles S. Berriman, Soap Gazette and Perfumer. 1902. 8vo. Pp. 178. Price $5.

The author's intention is evidently good. But sometimes he says things that irritate a trademark attorney. Mr. Lamborn constantly refers to "copyrighted" trademarks. If this book is ever published in a second edition we trust that he will substitute "registered" for the inaccurate "copyrighted." On page 49 the author refers to the Patent Office Record, a publication with which we are not familiar. Perhaps he refers to the Official Gazette. By far the most valuable portion of the work is an excellent list of registered ("copyrighted," the author calls it) trademarks for soap. That list expiates the sins mentioned.

A DICTIONARY OF DYES, MORDANTS, AND OTHER COMPOUNDS USED IN DYEING AND CALICO PRINTING. By Christopher Rawson, Walter M. Gardner and W. F. Laycock. London: Charles Griffin & Co. Philadelphia: J. B. Lippincott Company. 1901. Octavo. Pp. 374. Price $5.

The authors of this book are men whose names are intimately associated with the chemistry of dyeing. Their work seems to be a very complete lexicon of such dyes and mordants as are used in the dyeing and printing of calicoes. The dictionary will probably be of great practical value in the laboratories of color chemists. To many perhaps the lack of a method of applying the dyes and mordants will be felt; but such methods will be found fully described in the "Manual of Dyeing" prepared by the same authors.

WATER AND ITS PURIFICATION. A Handbook for the Use of Local Authorities, Sanitary Officers, and Others Interested in Water Supply. By Samuel Rideal, D.Sc. Second Edition, Revised and Extended. Philadelphia: J. B. Lippincott Company. London: Crosby, Lockwood & Son. 1902. 16mo. Pp. i-xvi, 346.

This is the second edition of a work which has proven of rare value to the sanitary engineer and to those who have been in any way interested in the water supply of large cities. In the present edition additional matter dealing with recent water problems and sand filtration has been included. The first chapter has been rewritten and new matter incorporated. In its revised form the book should certainly meet with a favorable reception.

TUBULAR TRANSIT FOR LONDON. By John Leighton, F.S.A. London, 1902. First Edition. Pp. 16.

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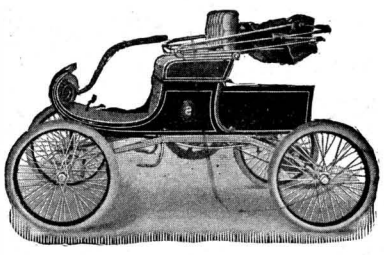

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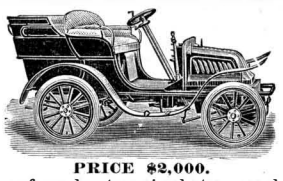

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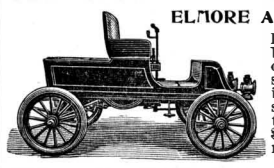

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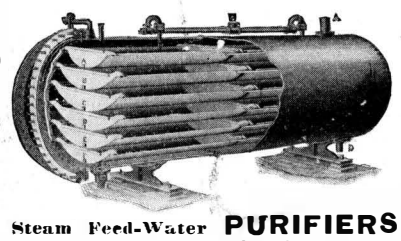

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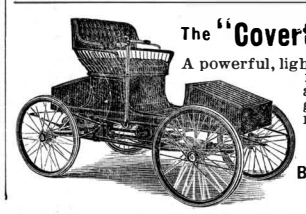

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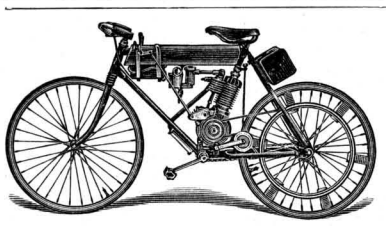

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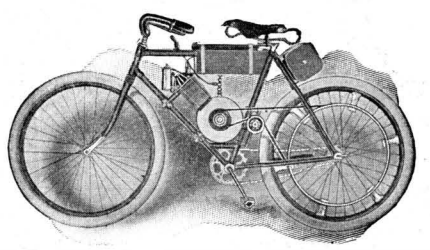

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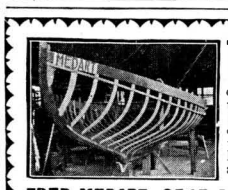

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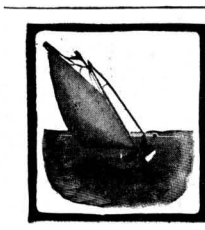

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(8587) M. and S. J. write: If iron or steel is properly cleaned before plating with nickel, it can be burnished like silver without peeling or stripping, therefore, the burnish is a good test for poorly nickeled goods, as the loose nickel will come off.

(8588) C. W. asks: Please inform me as to the difference between an aneroid and a holosteric barometer. A. The word *aneroid* is from two Greek words meaning without liquid, and the word *holosteric* is from two Greek words meaning wholly solid. They are two names for the same thing. There is no difference between them.

(8589) E. W. F. asks: We have a co-operative telephone system in operation here. One of the wires from the central office extends six miles to a neighboring town; and for one mile of its distance it runs parallel to a wire used by the electric lighting company, and carrying an alternating current of 2,200 volts. At night, when the current is on, the induction is so great as to interfere with the use of this branch. The bridging system is used in connecting the 'phones; one wire overhead and a ground plate for each instrument. Seventeen telephones are connected in this way on the line. Could this difficulty (induction) be overcome by stringing another wire to a point beyond the termination of the electric light wires and grounding the end, using it as a common ground for all the instruments? Is there a better way of overcoming the induction? A. The only way to completely remedy your difficulty with the induction of the alternating current along your line is to use a metallic circuit frequently crossed, as is done with the city lines and the long-distance lines. See Hopkins' "Telephone Lines and Their Properties."

(8590) H. O. writes: Can you give us a formula for a preparation for the tempering of mill picks? A. The treatment of mill picks before hardening is of far greater importance than any hardening preparation other than salt water, which is the only menstruum that we can recommend. No hardening solution can recover the lost properties of steel that has been overheated, burnt corners of mill picks, or hammering at above or below a full red heat. Cyanide of potassium dissolved in the hardening water or powdered and sprinkled on the red-hot point before dipping, or even common soap rubbed on the pick before heating, are used by experienced men in the business.

(8591) J. G. B. asks: 1. The theory of electricity as commonly accepted by the most prominent scientists. A. The theory held by scientists is that electricity is a disturbance of the ether of space. 2. Why should a sounder have a resistance equal to that of the line? A. The sounder is in the local circuit, and not in the line. Its resistance is usually for 2 to 5 ohms. 3. Is it amperage or coulombs that decompose an electrolyte? A. Amperes are *sometimes measured* by the amount of metal they deposit in a second. Coulombs are the product of amperes by seconds. 4. If a sufficiently sensitive voltmeter were connected with the terminals of a Ruhmkorff coil, having a 1 cm. spark, what would be the registered voltage? A. The voltage of a spark of 1 cm. is from 14,000 to 15,000 volts. 5. Is it the voltage or amperage that shock animal tissue? A. The voltage furnishes the power to force the amperes through the body. Both are necessary to the shock. 6. How does evaporation from ocean produce electrification of the vapor? I have heard the following theory advanced, but would like your opinion on it. The ocean possesses equal + and — electricity. When a drop of water turns into vapor, the change of surface is so great that the charge becomes less dense per unit surface than the earth, and so becomes negative. A. The process of electrifying the air is not understood. Till something is known, one theory may be as good as another, if it is satisfactory to the person accepting it. 7. In all long-distance polyphase current lines, where the voltage is perhaps as high as forty thousand, is not the amperage a fraction? A. The amperes are proportionally lower as the voltage is raised in long-distance transmission of electricity.

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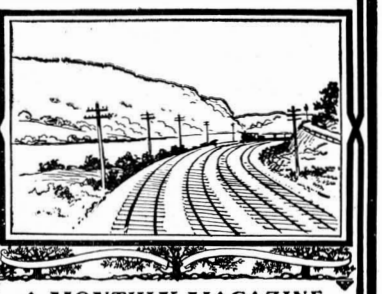

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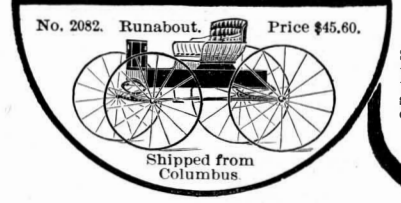

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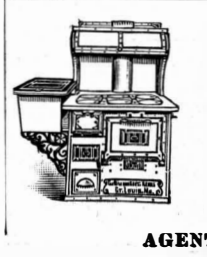

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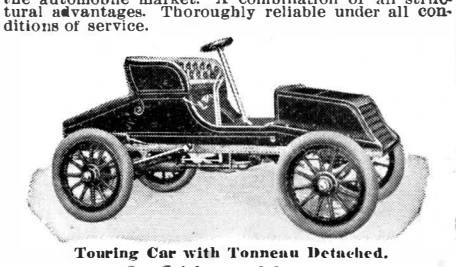

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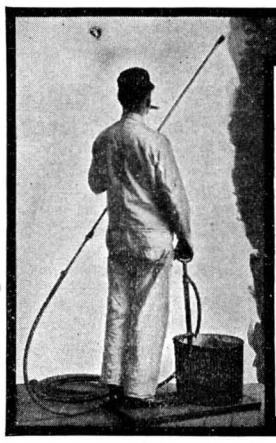

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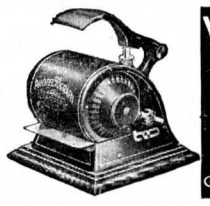

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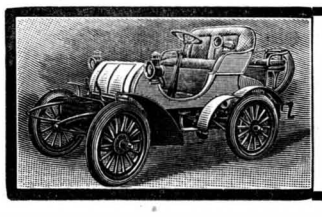

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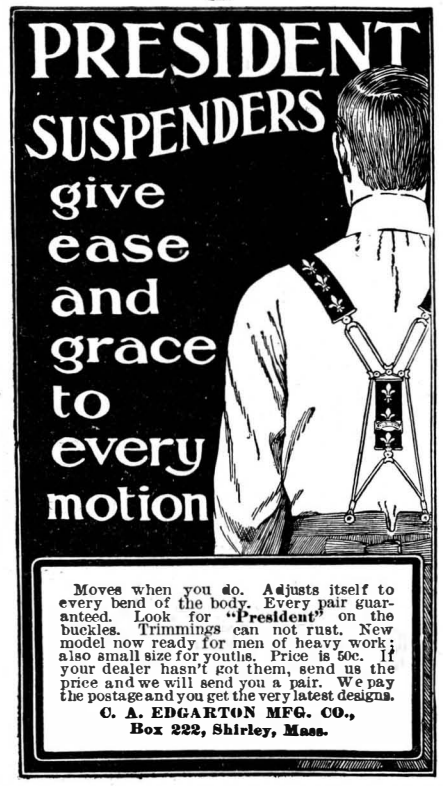

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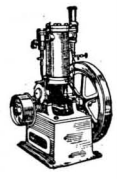

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